

TC 0076-06

FINAL REPORT REMEDIAL INVESTIGATION

BUILDING 218

CAMP NAVAJO BELLEMONT, ARIZONA

April 2000

Prepared for:

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and

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**REMEDIAL INVESTIGATION
AT
CAMP NAVAJO**

BUILDING 218

FINAL REPORT

Contract DACA05-93-D-0019

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LIST OF ACRONYMS

Acronym	Full Phrase
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ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
bgs	below ground surface
CEC	cation exchange capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	chemical of concern
DQO	data quality objective
FSSP	Former Sewage Sludge Pile
HA	hand auger
HBGL	health based guidance levels
LCS	laboratory control sample
LDC	Laboratory Data Consultants
MS	matrix spike
MSD	matrix spike duplicate
msl	mean sea level
OC	organochlorine
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RI	remedial investigation
RPD	relative percent difference
SB	soil boring
SS	surface soil
SVOC	semivolatile organic compound
TEPH	total extractable petroleum hydrocarbons
TOC	total organic carbon
TPHd	total petroleum hydrocarbons as diesel
TRPH	total recoverable petroleum hydrocarbons
TSCA	Toxic Substance Control Act
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UST	underground storage tank

LIST OF ACRONYMS

Acronym	Full Phrase
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VOC	volatile organic compound
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SECTION 1

INTRODUCTION

1.1. PURPOSE OF REPORT

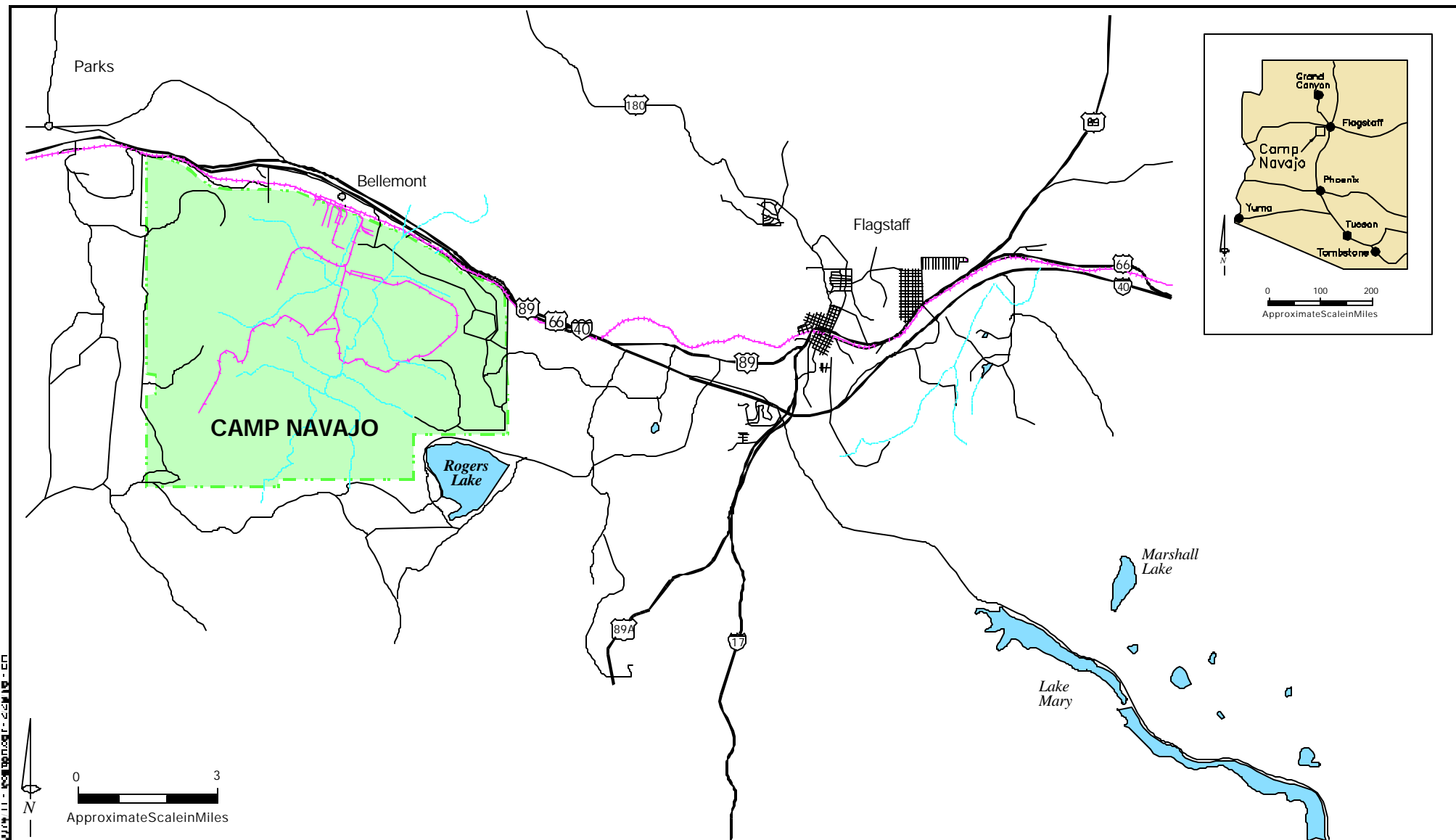
This report summarizes the results of the remedial investigation conducted on Building 218 (NAAD 24A, NADA 24A, AREE 24) (site) at Camp Navajo (formerly Navajo Depot Activity), in Bellemont, Arizona (Figure 1-1). Tetra Tech was retained by the United States Army Corps of Engineers (USACE) to conduct the work described in this report.

1.2. SITE BACKGROUND

1.2.1. Site Description





Building 218 is an 18,207 square foot, concrete-floored building with 12 bays on each side (Figure 1-2) and is located in the warehouse area (Figure 1-3) (Uribe 1993). The building was last used for automobile maintenance and is the backup facility for the rocket motor staging building. A spray painting booth was previously present in the east side interior room. The building is equipped for rail car maintenance and was presumably used for this purpose in the past. Placing an interior draining slab over the original floor has modified the floor at the extreme southern end of the building. Until their removal in October 1994, there were floor drains over sumps in the southwest and southeast corners of the raised area. These sumps were connected to Camp Navajo's sanitary sewer system. The southern end of the building also had a soil-filled oil change pit, an automobile hydraulic lift, and a railroad car hydraulic lift. The oil change pit and the hydraulic lifts were removed in October 1994. The floor of Building 218 is littered with bird feathers, bird droppings, rodent droppings, and bird carcasses (Uribe 1993).

In March 1992, Camp Navajo conducted a base-wide cleanup effort to collect and dispose of any accumulated wastes, which were placed in 170 drums. The drums were temporarily stored in Building 218 and gradually shipped off-site for disposal



Camp Navajo is in north central Arizona about 12 miles west of the city of Flagstaff.

LEGEND:

-  Highways
-  Roads
-  Railroad
-  Rivers/Streams

Camp Navajo Location Map

Camp Navajo
Bellemont, Arizona

Figure 1-1



Legend:

+++++ Railroad



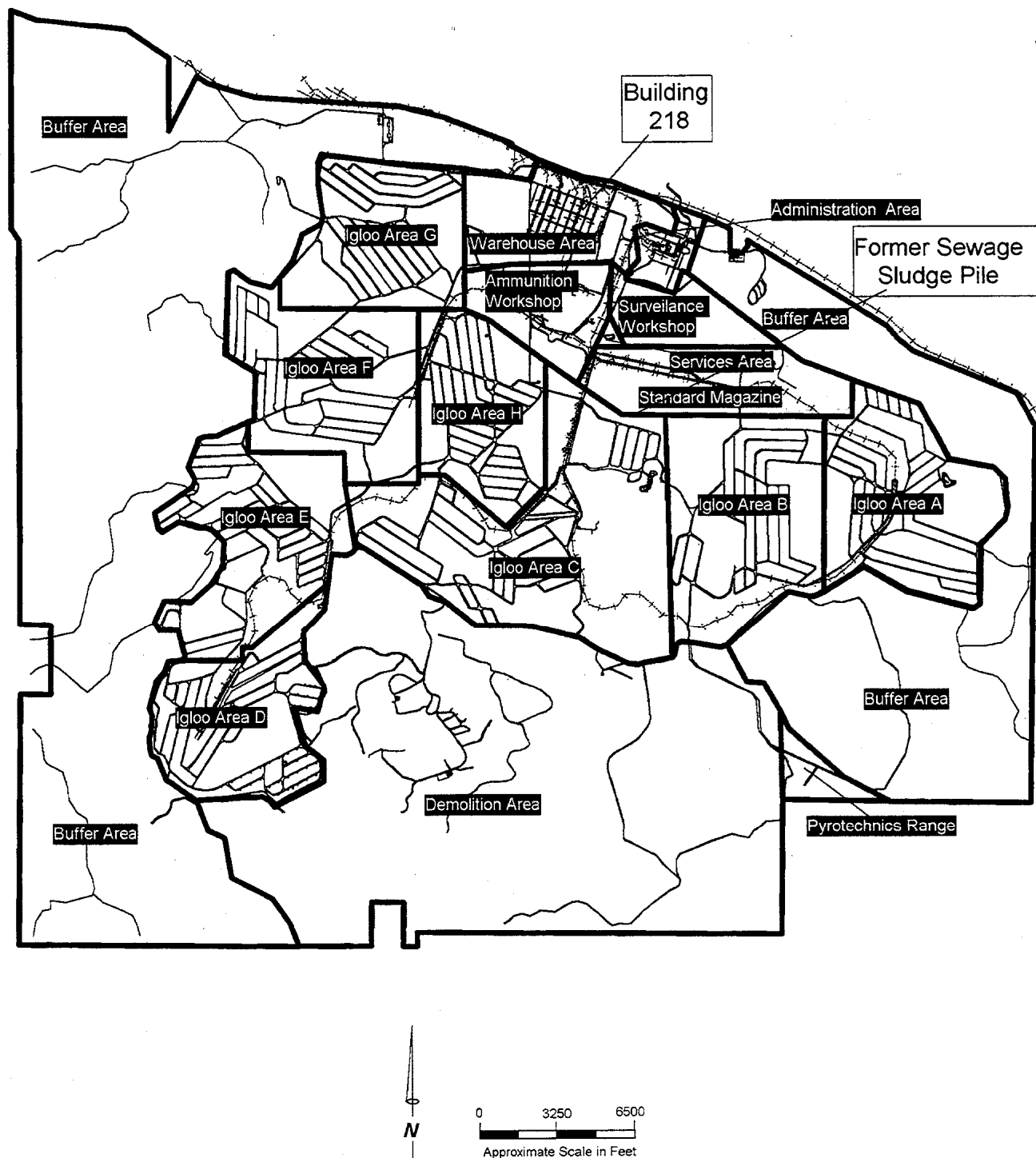
0 35 70
Approximate Scale in Feet

Building 218 - Spray Paint Operations

Site Plan

Camp Navajo, Bellemont, Arizona

Figure 1-2



Building 218

Site Map

Camp Navajo, Bellemont, Arizona

Figure 1-3

during the following year. As of January 1993, thirty of the drums had been shipped off-site. By October 1993 only three containers of waste materials remained (Uribe 1993).

1.2.2. Previous Investigations

An underground storage tank (UST) was suspected to be present under an old fuel island between Buildings 218 and 216. Capped fill pipes project from the island. However, in September 1994, the area was excavated and no UST was found. The pipes at the fuel island were found to have connected to a UST formerly located at Building 205. These pipes were removed and the excavation was sampled and backfilled (Tetra Tech 1995). Fifteen soil samples were collected from beneath the excavated piping. Samples contained total petroleum hydrocarbons as diesel (TPHd) (67 mg/kg), total recoverable petroleum hydrocarbons (TRPH) (18 to 170 mg/kg), toluene (1,400 µg/kg), ethylbenzene (1,700 µg/kg), and xylenes (nondetect to 8,000 µg/kg). Two ground water samples collected from the depressions at two soil sample locations contained TPHd (4.9 mg/L), TRPH (19 mg/L), toluene (8.7 µg/L), and xylenes (100 µg/L).

On December 4, 1992, a broken water pipe flooded the floor in Building 218. The water entered the vehicle lift sump and caused oil in the sump to overflow. The water and floating oil covered the surrounding shop floor and moved out of the building before the water to the building was shut off. In May 1993, about 48 cubic yards of soil affected by the spill outside the building were excavated and stockpiled on a concrete pad at the former location of Building 233. In June 1994, polychlorinated biphenyls (PCBs) were discovered in samples collected from the vehicle lift sump, two other sumps, and from a sample of the oil in the hydraulic lift reservoir. Based on these data, the Army concluded that PCBs may have been present in the oil that overflowed the vehicle lift sump in the 1992 spill. The concentration of PCBs in the hydraulic oil in the lift reservoir was 97 ppm, triggering cleanup requirements under the Toxic Substance Control Act (TSCA) regulations.

Camp Navajo reported the potential spill of PCBs to the USEPA on September 12, 1994, and requested assistance from the USACE, Sacramento District, to remove the PCB-containing liquids. The source liquids were removed from the sumps, the hydraulic oil was drained from the lift reservoir and the vehicle lifts, and were contained in drums on September 23, 1994. The drummed waste was shipped to US Ecology's TSCA-permitted facility in Beatty, Nevada, on October 11, 1994, where it was temporarily stored, pending acceptance for incineration at the Westinghouse Aptus incinerator facility in Aragonite, Utah. Three soil samples were collected from the surface of a soil-filled oil change pit, adjacent to the vehicle lift sump, and analyzed for PCBs. Results of these samples indicated the presence of PCBs in the soil in this pit.

On October 26, 1994, Camp Navajo requested the USACE's assistance in investigating further the Building 218 sumps. The sumps, hydraulic lift equipment,

soil around the sumps, and stockpiled soil from the May 1993 cleanup were removed and hauled to US Ecology's TSCA-permitted landfill facility in Beatty, Nevada, between October 31 and November 4, 1994. The floor of the building was steam-cleaned, the concrete pad was swept, and the residual soil and sediments were contained in drums. The drummed waste, including equipment decontamination water and personal protective equipment, was incinerated or landfilled.

During the removal of the sumps, twenty-five soil samples were collected from the spill area and the sumps. These samples were analyzed in the field, using Millipore immunoassay test kits, which had a detection limit of 1 ppm. PCBs were not detected in any of the samples analyzed.

Following the sump removal, verification sampling of the concrete floor of Building 218 was performed by collecting 16 standard wipe samples on a grid pattern. An additional eight wipe samples were collected from the concrete pad where the soil previously excavated from the spill area had been stockpiled. Thirty-seven verification surface soil samples were collected in the spill area outside the building and from the walls and floors of the excavation pits created by removing the sumps. Two soil samples also were collected from along the railroad tracks inside the building, and eight soil samples were collected outside Building 218 from beneath the temporary soil and debris stockpile and the equipment decontamination pad set up during the response action. Only one verification sample contained a detectable concentration of PCBs at 42 µg/kg. This sample was collected from just outside the area excavated in 1993.

Two of the sumps, located at the south end of the building, originally were designed as oil/water separators. Discharge piping was traced from the sumps to a recently-installed PVC line outside the building. The PVC piping apparently replaced an older system of ceramic pipe. The new piping system was installed adjacent to the older system, which remains in place. Excavation and inspection of a portion of the older piping system revealed no evidence of leakage from the system and no sedimentation within the piping. No PCBs were detected in two samples collected from soils immediately beneath two joints in the piping. The fact that the sumps were connected to the sanitary sewer system suggests that oily wastes or PCBs may have migrated into the system and be present in sewage sludge from the treatment system.

The investigation demonstrated that no residual PCBs from the spill of December 4, 1992, were present in the subsurface soil around or beneath the concrete sumps at concentrations exceeding the action level (180 µg/kg). The verification samples also indicate that PCBs were not present in the spill area outside the building or in the surface water drainage pathway outside the building at concentrations exceeding the action level. Note that PCBs were detected in one sample (218-SS42) at 42 µg/kg.

Soil samples collected from the sump excavations also were analyzed for TRPH and TPHd. Results indicated concentrations of TRPH (ND to 4,100 mg/kg) and TPHd

(ND to 900 mg/kg) in the subsurface soils around these sumps. The extent of this contamination was not defined.

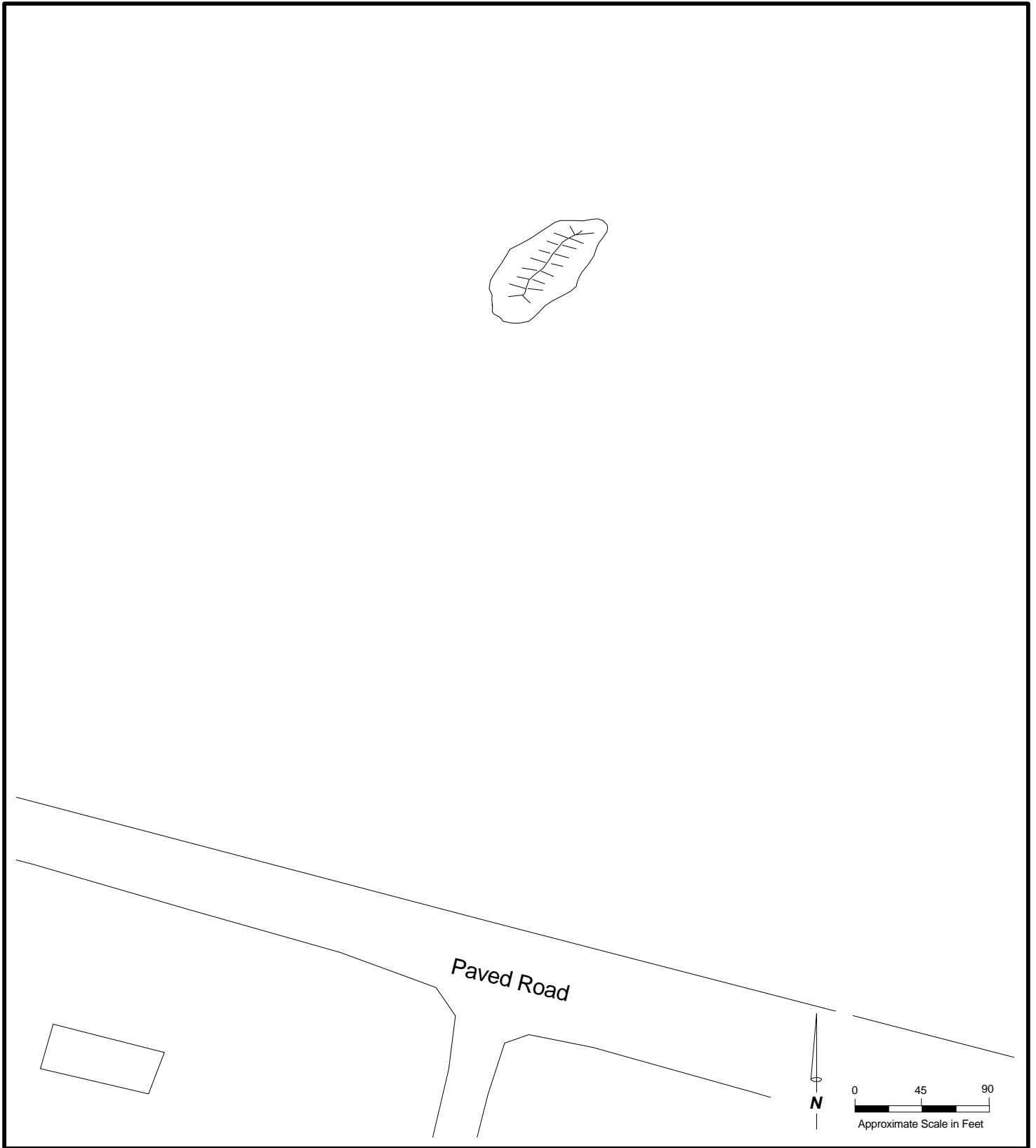
USEPA has accepted the results of the investigation and has considered the site closed, pending sampling of the former sewage sludge pile (FSSP) east of the Current Construction Debris Landfill (Figure 1-4).

1.3. STATEMENT OF THE PROBLEM

Previous site operations are likely to have generated metal, petroleum hydrocarbon, and solvent wastes. Some of these waste materials may have been thrown out the doors of the building for disposal. In addition, because operations at this site involved the handling of a liquid waste product (petroleum hydrocarbons and solvents), it is likely that spills occurred periodically. Of specific concern at the site is identifying contamination in the soils beneath and surrounding the building. The USEPA also has requested that confirmation samples be collected from the FSSP to confirm that there are no PCBs from the sumps within Building 218 in the sewage sludge.

1.4. REPORT ORGANIZATION

This report follows United States Environmental Protection Agency (USEPA) guidance for remedial investigation (RI) reports in the Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA 1988). Section 2 describes the field investigations conducted as part of the RI. Sections 3 and 4 present the physical and chemical results, respectively. Section 5 presents a discussion of the fate and transport characteristics of the contaminants. Section 6 presents risk screening for the identified contaminants. All results are summarized with conclusions in Section 7.



Legend:

----- Slope

Former Sewage Sludge Pile

Site Plan

Camp Navajo, Belmont, Arizona

Figure 1-4



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SECTION 2

SAMPLING PROGRAM

2.1. SAMPLING OBJECTIVES

The specific objectives of the investigation at the Building 218 included identifying buried piping for subsurface sampling, characterizing the nature and extent of surface and subsurface contamination from maintenance activities that could have been discharged to the site. The USEPA has also requested that confirmation samples be collected from the FSSP to confirm that there are no PCBs from the sumps within Building 218 in the sewage sludge.

2.2. SAMPLING APPROACH

Photo documentation is provided in Appendix A. Field notes are presented in Appendix B. Field investigations were conducted in accordance with the procedures outlined in the field sampling plan provided in Appendix C. Geophysical survey results can be found in Appendix D. Appendix E shows the soil boring logs. Surveyor results can be found in Appendix F.

Task 1: Geophysics

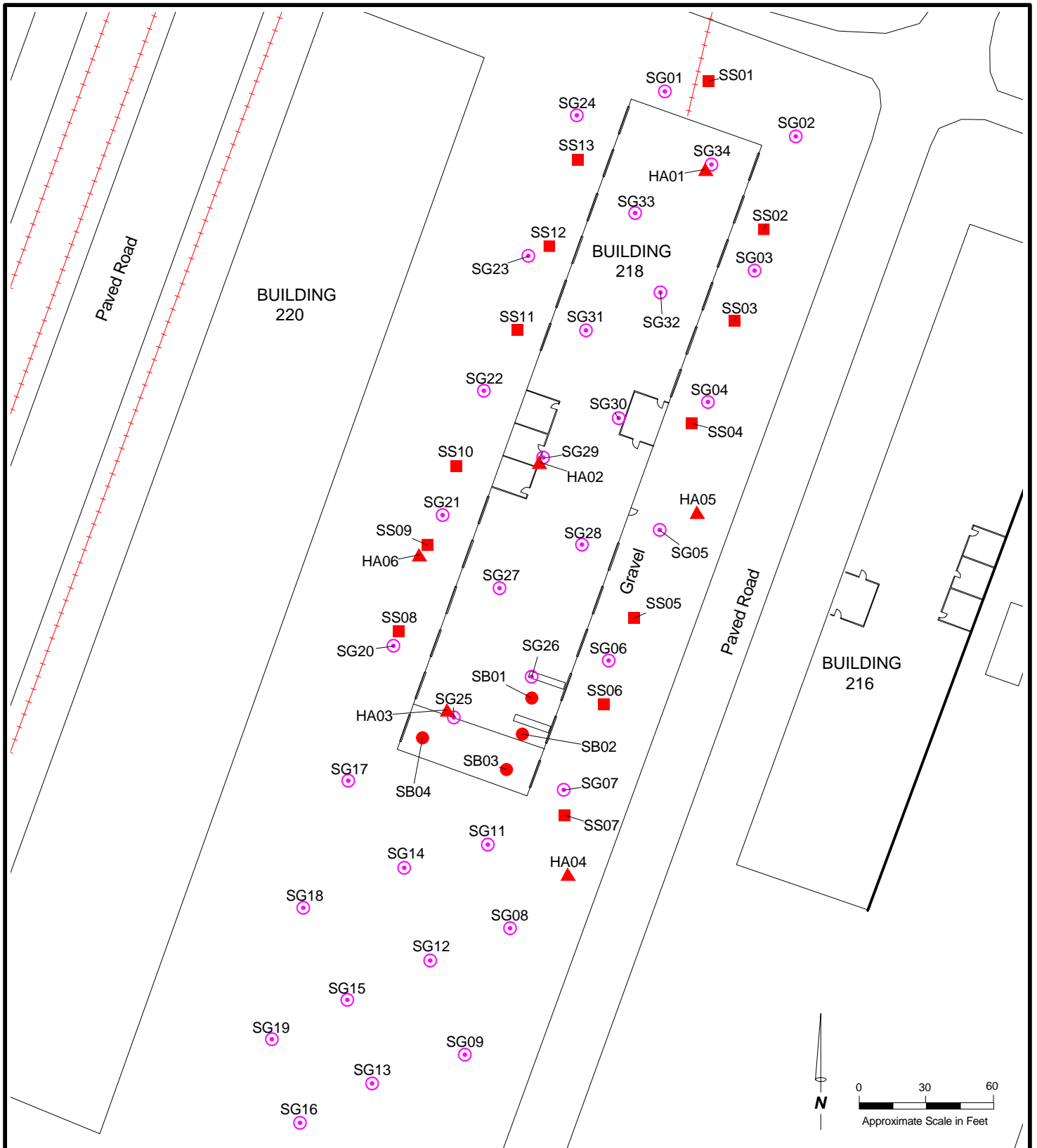
A line locating survey was conducted in a 20-foot zone surrounding the building and in any areas of soil gas sampling. In areas where possible drain piping was discovered, the piping was traced from its origin point to its discharge point.

Task 2: Passive Soil Gas Survey






Soil gas probes were installed at 34 locations inside and surrounding the building and in the gravel lot south of the building (Figure 2-1). The probes were installed on a 40 by 60-foot grid.

Task 3: Surface Soil Sampling

Surface soil sampling was performed in the general area surrounding the building. Areas adjacent to every other door were targeted for sample collection. Thirteen surface soil samples were taken at the locations shown in Figure 2-1, and four



Legend:

- | | | | |
|---|----------------------|---|-------------------------------------|
|  | Hand Auger Location |  | Soil Gas Location |
|  | Soil Boring Location |  | Surface Soil Sample/Sediment Sample |
|  | Railroad | | |

Building 218

Investigation Plan

Camp Navajo, Bellemont, Arizona

Figure 2-1



Tetra Tech, Inc.

additional surface soil samples were collected from the FSSP (Figure 2-2). Samples were collected by driving a 2-inch by 12-inch California modified split spoon sampler, as described in Appendix C. As shown in Table 2-1, surface soil samples from Building 218 were analyzed for metals, and petroleum hydrocarbons. Two samples also were analyzed for bulk density and grain size. Four samples also were analyzed for total organic carbon (TOC) and redox potential. Two surface soil samples from the sludge pile were composited and analyzed for metals, PCBs, nitrate/nitrite, and ammonia nitrogen. PCB analysis of the FFSP was requested by the USEPA. Additional analyses were requested by base personnel. One sample was analyzed for bulk density and grain size. Two samples also were analyzed for TOC and redox potential.

Task 4: Hand Auger Sampling

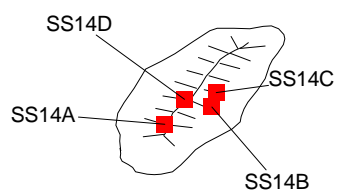
Six hand auger locations were sampled within and surrounding the building. Hand auger sampling was done to a maximum depth of five feet bgs. Samples were collected at 0.5, 2.5, and five feet bgs from the three locations within the building and at 2.5 and five feet bgs from the three locations surrounding the building. Samples were collected by driving a 2-inch by 12-inch California modified split spoon sampler, as described in Appendix C. Soil samples were analyzed for metals, petroleum hydrocarbons, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and pH, as shown in Table 2-1. Two samples also were analyzed for bulk density and grain size. Four samples also were analyzed for TOC and redox potential.

Task 5: Soil Boring and Sampling

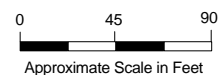
Four borings were drilled and installed through the locations of the former oil sumps inside Building 218. The sample depths were determined in the field based on lithology. Samples were collected from fine-grained soils collected in the sample cores. If discrete fine-grained units were not identifiable within the cores, then one sample was submitted for analysis from each of the following depth intervals: 15 to 20 feet, 20 to 25 feet, and 25 to 30 feet. Drilling was conducted using hollow stem augers on a CME 75 HT rig, as described in Appendix C. Samples were collected by driving a 2-inch by 12-inch California modified split spoon sampler, as described in Appendix C. Split spoon sampling was done in accordance with ASTM D1586. As shown in Table 2-1, each soil sample was submitted to the laboratory for analysis for metals, petroleum hydrocarbons, VOCs, and SVOCs. One sample also was analyzed for bulk density and grain size.

Task 6 Surveying


After the investigations were completed, Aztech Surveying, an Arizona-licensed land surveyor, surveyed the horizontal location of the samples. Horizontal coordinates for each location were surveyed relative to a permanent control point established on-site. Horizontal control is accurate to ± 0.1 feet. Elevations of the soil borings were not surveyed because ground water was not encountered in the borings. Sample locations in Figures 2-1 and 2-2 are based on survey results. A table of surveyed sample locations is included in Appendix F.



Paved Road



Legend:

-  Slope
-  Surface Soil Sample/Sediment Sample

Former Sewage Sludge Pile

Investigation Plan

Camp Navajo, Bellemont, Arizona

Table 2-1
Building 218 Sample Analyses

Sample ID	Sample Date	Depth (feet)	Media	Percent Water ASTM D2216	pH SW9045B	Total Organic Carbon WBLACK	Redox Potential ASTM D1498	Dry Density ASTM D2937	Particle-Size Distribution ASTM D422	Metals SW6010A	Mercury SW7471A	Petroleum Hydrocarbons BLS-19I	Petroleum Hydrocarbons BLS-418 1 AZ	Volatile Organic Compounds SW8260A	Semivolatile Organic Compounds SW8270B	OC Pesticides and PCBs SW8081
218-SS01S-01	9/26/95	1	Soil	X	X					X	X	X	X			
218-SS02S-01	9/26/95	1	Soil	X	X					X	X	X	X			
218-SS03S-01	9/26/95	1	Soil	X	X					X	X	X	X			
218-SS04S-01	9/26/95	1	Soil	X	X	X	X	X	X	X	X	X	X			
218-SS05S-01	9/26/95	1	Soil	X	X					X	X	X	X			
218-SS06S-01	9/26/95	1	Soil	X	X					X	X	X	X			
218-SS07S-01	9/26/95	1	Soil	X	X					X	X	X	X			
218-SS08S-01	9/26/95	1	Soil	X	X					X	X	X	X			
218-SS09S-01	9/26/95	1	Soil	X	X					X	X	X	X			
218-SS10S-01	9/26/95	1	Soil	X	X					X	X	X	X			
218-SS11S-01	9/26/95	1	Soil	X	X					X	X	X	X			
218-SS12S-01	9/26/95	1	Soil	X	X					X	X	X	X			
218-SS13S-01	9/26/95	1	Soil	X	X	X	X	X	X	X	X	X	X			
218-SS14S-01*	9/26/95	1	Soil	X	X	X	X			X	X	X	X			X
218-SS15S-01*	9/26/95	1	Soil	X	X	X	X			X	X	X	X			X
218-HA01S-01	5/3/96	0.5	Soil	X	X					X	X	X	X			
218-HA01S-02	5/3/96	2.5	Soil	X	X					X	X	X	X	X	X	
218-HA01S-03	5/3/96	5	Soil	X	X					X	X	X	X	X	X	
218-HA02S-01	4/21/96	0.5	Soil	X	X					X	X	X	X			
218-HA02S-02	4/21/96	2.5	Soil	X	X					X	X	X	X	X	X	
218-HA02S-03	4/21/96	5	Soil	X	X					X	X	X	X	X	X	
218-HA03S-01	5/3/96	0.5	Soil	X	X					X	X	X	X	X	X	X
218-HA03S-02	5/3/96	2.5	Soil	X	X					X	X	X	X	X	X	X

Table 2-1
Building 218 Sample Analyses
(continued)

Sample ID	Sample Date	Depth (feet)	Media	Percent Water ASTM D2216	pH SW9045B	Total Organic Carbon WBLACK	Redox Potential ASTM D1498	Dry Density ASTM D2937	Particle-Size Distribution ASTM D422	Metals SW601A	Mercury SW7471A	Petroleum Hydrocarbons BLS-191	Petroleum Hydrocarbons BLS-418 1 AZ	Volatile Organic Compounds SW8260A	Semivolatile Organic Compounds SW8270B	OC Pesticides and PCBs SW8081	Ammonia as N USEPA350.3	Nitrate plus Nitrite as N USEPA353.2
218-HA04S-01	4/21/96	2.5	Soil	X	X	X	X	X	X	X	X	X	X	X	X			
218-HA04S-02	4/21/96	5	Soil	X	X					X	X	X	X	X	X			
218-HA05S-01	4/21/96	2.5	Soil	X	X	X	X	X	X	X	X	X	X	X	X			
218-HA05S-02	4/21/96	5	Soil	X	X					X	X	X	X	X	X			
218-HA06S-01	4/21/96	2.5	Soil	X	X					X	X	X	X	X	X	X		
218-HA07S-01*	4/21/96	2.5	Soil	X	X	X	X			X	X	X	X	X	X			
218-HA07S-02*	4/21/96	2.5	Soil	X	X	X	X			X	X	X	X	X	X			
218-SB01S-01	4/30/96	10	Soil	X	X					X	X	X	X		X			
218-SB02S-01	4/30/96	10	Soil	X	X					X	X	X	X		X			
218-SB02S-02	4/30/96	15	Soil	X	X					X	X	X	X		X			
218-SB03S-01	4/30/96	10	Soil	X	X			X	X	X	X	X	X		X			
218-SB04S-01	4/30/96	10	Soil	X	X					X	X	X	X		X			
218-SB04S-02	4/30/96	15	Soil	X	X					X	X	X	X		X			
218-SB05S-01*	4/30/96	11	Soil	X	X					X	X	X	X		X			
FSSP-SS14S-01	10/24/95	1	Soil	X		X	X	X	X	X	X					X	X	X
FSSP-SS15S-01*	10/24/95	1	Soil	X		X	X			X	X					X	X	X

Notes:

* Blind duplicate sample (see section 4.4)
 ASTM American Society for Testing and Materials

2.3. SAMPLE ANALYSIS

Thirty-four passive soil gas probes and 39 soil samples were collected and analyzed during this investigation. The soil gas probes were analyzed for a select suite of VOCs, SVOCs, and petroleum hydrocarbons by Gore Laboratories in Maryland. Soil sample analyses conducted as part of this investigation included metals, VOCs, SVOCs, petroleum hydrocarbons, PCBs, pesticides, TOC, redox potential, percent water, and pH by Quanterra Laboratories in California. Six soil samples also were analyzed for bulk density and particle-size distribution by Earth Tech Laboratories in California. [Table 2-1](#) summarizes the samples collected and the types of analyses conducted on each sample.

SECTION 3

PHYSICAL CHARACTERISTICS

3.1. SURFACE FEATURES

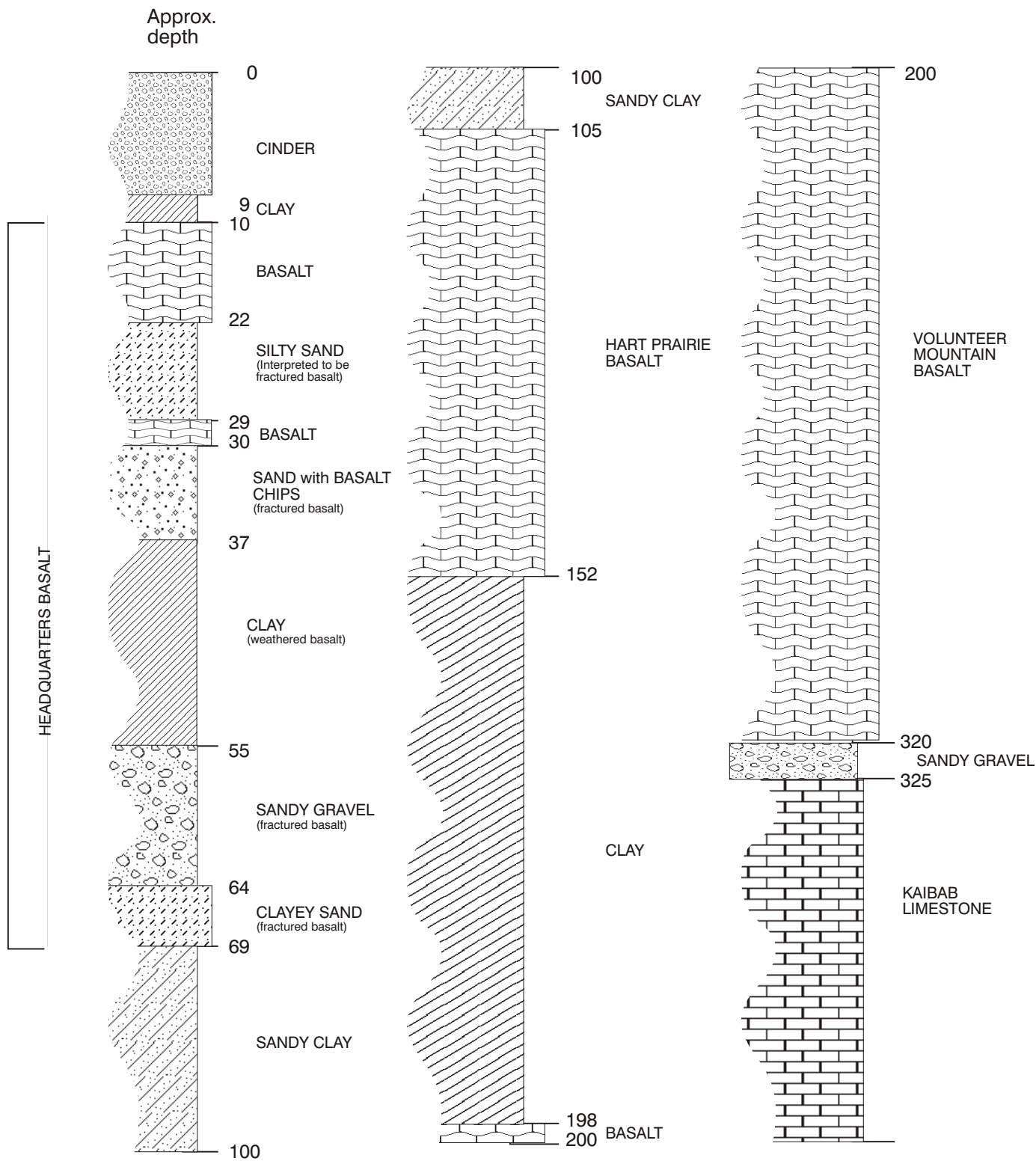
Surface features at the site consist of an 18,207 square feet, concrete-floored steel-framed building with 12 bays on each side (Building 218) and a derelict brick heating plant (Building 217). The building is located in the central portion of the warehouse area between Buildings 220 and 216 (Figure 1-2). The ground on each side of Building 218 is covered by a 20-foot wide strip of concrete pavement. Unpaved ground surface surrounding the building is covered with gravel or grass.

The topography in the area of Building 218 is generally of low relief, and slopes to the south. There is a northeast-southwest trending escarpment approximately 2,500 feet east of the site (Bellemont Fault). This feature has a drop in ground surface elevation of about 80 feet. Ground surface generally consists of gravel with less than 50 percent of sand.

3.2. GEOLOGY

The following description of the geologic units deeper than 20 feet is compiled from surface geologic mapping, from soil borings in other portions of the Warehouse Area, and from geophysical surveys (Figures 3-1 and 3-2) (Tetra Tech 1999a, 1998). A monitoring well drilled in 1996 approximately 500 feet southeast of the site encountered a thin veneer (<10 feet) of clayey soil overlying a thickness of basalt. This basalt is interpreted to be the Headquarters Basalt that underlies the entire Warehouse Area as well as the adjacent Administration Area. The flow is estimated to be about 60 feet thick and overlies a thickness (<35 feet) of Camp Navajo Clay. The Camp Navajo Clay was deposited directly on top of a second basalt flow. This second basalt flow is interpreted to be the Hart Prairie basalt and is 45 feet thick. Below the second basalt is a second clay (45 feet thick) and a third basalt. The third basalt is interpreted to be the Volunteer Mountain basalt and is 120 feet thick. Below the third basalt is a thin zone of gravel and weathered Kaibab Formation (<20 feet) and the underlying Kaibab Formation.

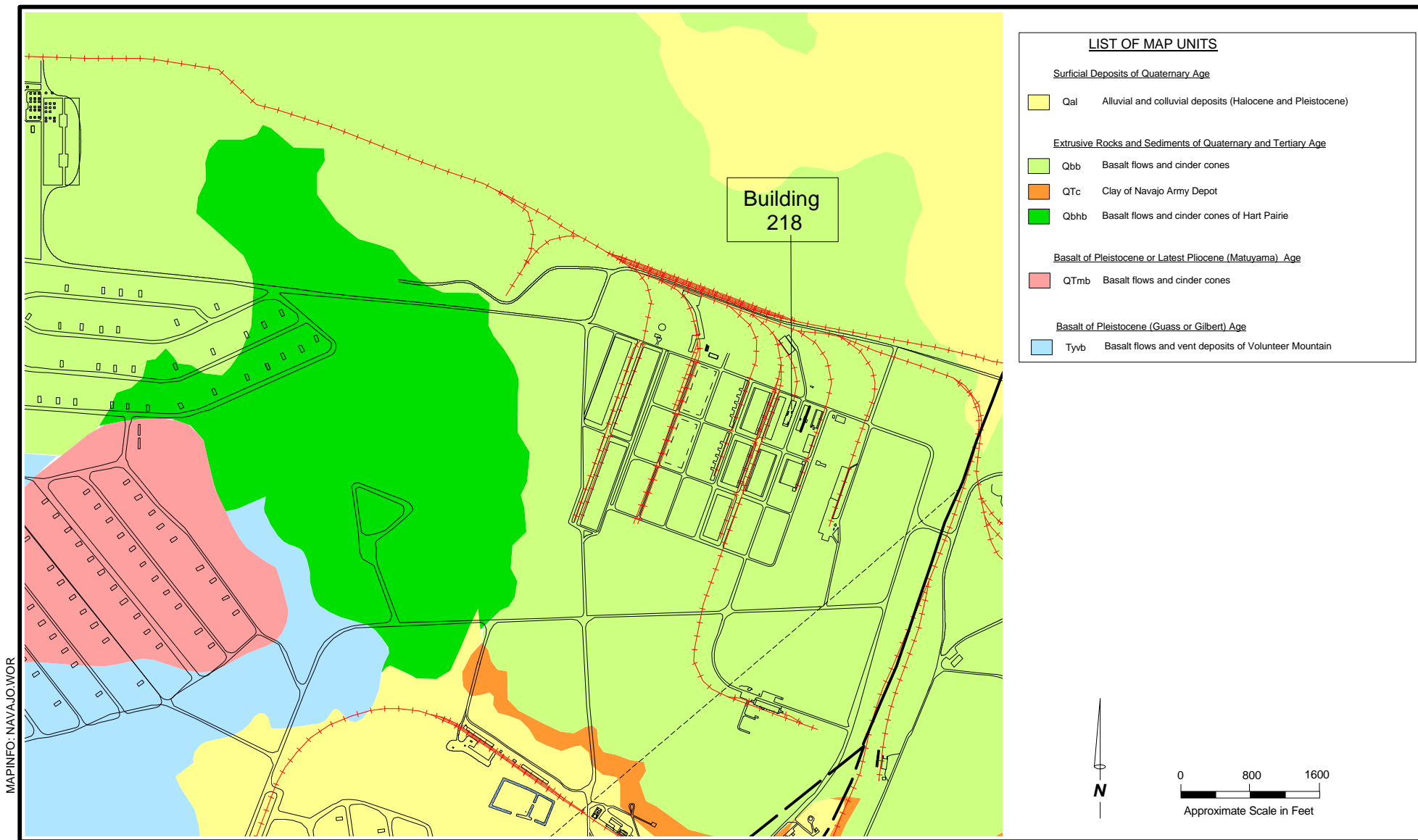
r:\0076\06\218strat.cdr - 7/24/98 - BC



Source: Tetra Tech, 1996

Building 218 Stratigraphy

Camp Navajo
Bellemont, Arizona



3.3. SOILS

The soils beneath the site have been classified by the Navajo Army Depot Soil Survey, Coconino County, Arizona, as Soil Unit 10 (USDA 1970). These are moderately deep gravelly clay soils with a loam surface and usually have zero to five percent slopes. The surface soil is generally a brown granular loam, having a pH of 7.0 and a thickness of three to five inches. The subsoil is generally a dark reddish gray gravelly clay with a blocky structure, having a pH of 7.8 and a thickness of 20 to 30 inches. This type of soil comprises approximately five percent of Navajo Army Depot soils, which accounts for approximately 1,400 acres of land on the base.

Physical testing of the soil samples collected during this investigation showed moisture ranging from 11.5 percent up to 63.0 percent. Dry densities of the soils range from 39.5 pounds per cubic foot (pcf) up to 96.4 pcf. Grain size distributions ranged from 1 percent gravel, 26 percent sand, 12 percent fines up to 34 percent gravel, 54 percent sand, and 73 percent fines. All physical analysis results are included in Appendix I.

3.4. HYDROGEOLOGY

Four water bearing zones have been identified within the upper 2,000 feet beneath the warehouse area. The uppermost zone, which feeds the springs from which the base receives its water supply, exists in fractures in the bottom of the uppermost basalt flow. The bottom of this zone is marked by a 30-foot thick clay aquitard at a depth of 70 feet bgs. A second water bearing zone exists in fractures at the base of the second basalt flow and is bounded on the bottom by a second clay aquitard at a depth of 150 feet bgs. A third water bearing zone exists in a 50-foot thick deposit of stream gravels and volcanic cinder that directly overlies the Kaibab Formation at a depth of 350 feet bgs. The fourth water bearing zone is the regional aquifer in the Coconino and Supai Formations at a depth of about 1,300 feet bgs.

Ground water recharge to the various water bearing zones occurs along fractures in the basalt flows and through fractures in the underlying Kaibab limestone. The presence and lateral continuity of the aquitards suggests that downward migration does not occur homogeneously throughout the area but is limited to areas of fracturing and faulting. In addition, the existence of the water bearing zones within fractures in the basalt suggests that contaminant migration would not be predictable using standard hydrogeologic techniques. Thus, remediation of contaminants in the ground water within the basalt zones would be problematic.

Ground water was not encountered during drilling at Building 218. Laterally discontinuous perched ground water conditions may exist throughout the alluvium. Drilling northeast, southwest, and east of the site also identified perched ground water within fractures in the basalt overlying the Camp Navajo Clay. Deeper ground water is likely to be present at an approximate depth of 1,300 feet bgs. This is based on the depth to the regional aquifer as measured in the deep water supply well 8,000 feet south of the site.

3.5. GEOPHYSICAL SURVEY

A line locating survey was conducted around and beneath the building to prevent accidental damage to buried utilities in the area during the field investigation. During this survey, all water supply lines and drain lines were identified and marked on the ground surface.

Three soil gas locations were moved because of an electrical conduit. One soil gas probe was moved due to a 2-inch gas line. Tetra Tech attempted to locate the drain in southeast corner of building without success-

SECTION 4

NATURE AND EXTENT OF CONTAMINATION

The following section summarizes the nature and extent of contamination identified at Building 218. All soil gas results are located in Appendix G. All analytical results are tabulated by analysis method in Appendix H. Soil physical characteristics are in Appendix I. Appendix J includes copies of all laboratory reports for this site.

4.1. SOIL GAS

Soil gas samples collected from beneath and surrounding Building 218 contained detectable concentrations of 11 compounds. The soil gas samples analyses results were used to select specific subsurface soil samples for analyses for VOCs and SVOCs (Appendix E).

The only significant detections of petroleum compounds (greater than one microgram per sorber [$\mu\text{g/sorber}$]) was at SG05 (undecane at $3.24 \mu\text{g/sorber}$), SG25 (undecane at $1.58 \mu\text{g/sorber}$, tridecane at $2.98 \mu\text{g/sorber}$), and SG27 (tridecane at $1.24 \mu\text{g/sorber}$). Petroleum compounds were considered to be contaminants of concern at this site and were investigated during the soil sampling program.

The only significant detection of any VOC at the site was at SG25 (1,3,5-trimethylbenzene at $1.23 \mu\text{g/sorber}$). To evaluate this detection, hand auger HA03 was located adjacent to SG25 to verify of subsurface contaminants.

The only significant detections of SVOC at the site were also at SG25 (naphthalene at $4.18 \mu\text{g/sorber}$, 2-methyl phenol at $21.50 \mu\text{g/sorber}$, acenaphthene at $1.32 \mu\text{g/sorber}$, and fluorene at $1.89 \mu\text{g/sorber}$).

Hand auger boring HA03 relocated adjacent to SG25, verified presence of subsurface contaminants identified in soil gas survey. The remaining hand augers were moved to SG29 and SG34 and provided additional verification of nondetected results. Soil borings SB05 through SB07 were converted to hand augers (HA04, HA05, and HA06) and were moved to SG24, SG05, and SG20, respectively. HA04

and HA06 verified nondetected results. HA05 verified a detected concentration of petroleum hydrocarbons.

4.2. SURFACE SOILS

Concentrations of various metals occur naturally in soils. With the exception of cadmium, lead, mercury, and selenium, no metals were identified at concentrations above background in any of the surface soil samples collected at this site (Table 4-1). Concentrations of cadmium were detected above background (1.5 mg/kg) in the two surface soil samples taken at the FSSP (up to 6.7 mg/kg). Concentrations of lead were detected above background (30 mg/kg) in seven surface soil samples (up to 154 mg/kg) at Building 218 (Figure 41). Concentrations of lead were detected above background (30 mg/kg) in both surface soil samples (up to 226 mg/kg) at FSSP. Concentrations of selenium were detected above background (0.8 mg/kg) in both surface soil samples (up to 5.5 mg/kg). All detected metals concentrations, except for arsenic and beryllium, were detected at concentrations less than the Arizona Department of Environmental Quality (ADEQ) nonresidential Health Based Guidance Levels (HBGLs). Arsenic and beryllium were found at concentrations higher than the ADEQ nonresidential HBGLs, but the concentrations are within background ranges previously defined for the installation (Tetra Tech 1997).

Background concentrations were established by statistical analysis of all samples collected at Camp Navajo. Outliers were identified during the analysis and were eliminated from the statistical test prior to determination of the background concentrations (Tetra Tech 1997).

Concentrations of petroleum hydrocarbons were identified in 16 of the surface soil samples collected at this site (Table 4-2). Concentrations of TRPH were detected in 16 surface soil samples (up to 610 mg/kg) (Figure 4-2). The other detected petroleum hydrocarbon (Diesel Fuel #2) was detected at low concentrations (up to 67 mg/kg) and is evaluated in Section 5.

Three organochloride (OC) pesticides were identified in both surface soil samples collected from the FSSP (Table 4-3). The three pesticides (4,4-DDD, 4,4-DDE, and 4,4-DDT) were identified at concentrations below ADEQ nonresidential HBGLs and thus are not considered to be contaminants of concern.

4.3. SUBSURFACE SOILS

Concentrations of various metals occur naturally in soils. With the exception of selenium, no metals were identified at concentrations above background in any of the surface soil samples collected at this site (Table 4-1). Concentrations of selenium were detected above background (0.8 mg/kg) in four subsurface soil samples (up to 1.7 mg/kg). All detected metals concentrations, except for arsenic and beryllium, were detected at concentrations less than the ADEQ nonresidential HBGLs. Arsenic

Table 4-1
Building 218 Metals Results
 (Detections Only)

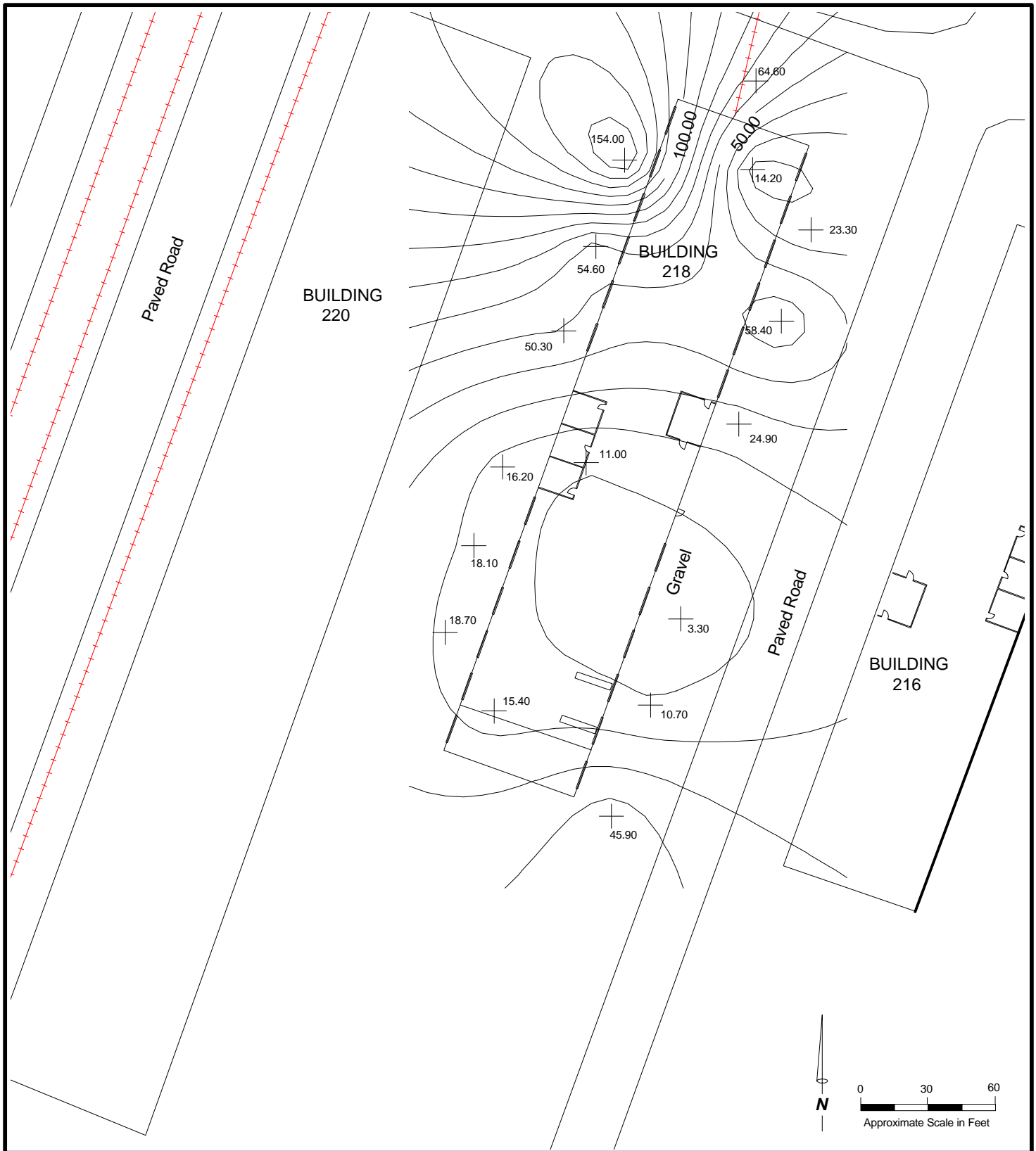
Sample ID	Sample Date	Depth	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Chromium, Total	Lead, Total	Mercury, Total	Potassium, Total	Selenium, Total	Silver, Total
		CRQL	0.5	2	0.2	0.2	0.5	0.5	0.2	500	0.5	0.5
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
218-SS01S-01	9/26/95	1	0.95	127	0.38	0.39	26.6 ^{J-}	64.6 ^{J-}	<0.033	1290	<0.3	0.16 ^J
218-SS02S-01	9/26/95	1	5.6	33.1	0.35 ^J	<0.1	12.4 ^{J-}	23.3 ^{J-}	<0.033	1270	<0.6	<0.2
218-SS03S-01	9/26/95	1	3.2	37.4	0.28	<0.05	11 ^{J-}	58.4 ^{J-}	<0.033	1030	0.52 ^J	<0.1
218-SS04S-01	9/26/95	1	1.2	70.1	0.45	0.32 ^U	9.1 ^{J-}	24.9 ^{J-}	<0.1	890	<0.3	<0.1
218-SS05S-01	9/26/95	1	2.7	108	0.41	<0.05	13.9 ^{J-}	3.3 ^{J-}	<0.033	1390	<0.3	<0.1
218-SS06S-01	9/26/95	1	2	101	0.43	<0.05	11.2 ^{J-}	10.7 ^{J-}	<0.033	1110	<0.3	<0.1
218-SS07S-01	9/26/95	1	0.93	81	0.38	0.56	17.2 ^{J-}	45.9 ^{J-}	0.11 ^J	975	<0.3	0.14 ^J
218-SS08S-01	9/26/95	1	1.9	217	1.1	0.41	19.2 ^{J-}	18.7 ^{J-}	<0.033	1460	<0.3	0.25 ^J
218-SS09S-01	9/26/95	1	1.9	316	1.4	0.25 ^U	22.7 ^{J-}	18.1 ^{J-}	<0.033	1800	<0.3	0.29 ^J
218-SS10S-01	9/26/95	1	2.5	326	1.3	0.12 ^U	18.1 ^{J-}	16.2 ^{J-}	<0.033	1490	<0.3	0.24 ^J
218-SS11S-01	9/26/95	1	2	190	0.69	0.21 ^U	16.6 ^{J-}	50.3 ^{J-}	<0.033	895	<0.3	0.21 ^J
218-SS12S-01	9/26/95	1	1.7	119	0.6	0.49	16.1 ^{J-}	54.6 ^{J-}	<0.033	1060	0.34 ^J	0.24 ^J
218-SS13S-01	9/26/95	1	2.6	293	0.82	0.28 ^U	14.5 ^{J-}	59.5 ^{J-}	<0.1	1310	<0.3	0.24 ^J
218-SS14S-01	9/26/95	1	1.1	85.2	0.46	0.45	9.3 ^{J-}	21.3 ^{J-}	<0.033	838	<0.3	<0.1
218-SS15S-01	9/26/95	1	2.2	218	0.79	0.32 ^U	17.2 ^{J-}	154 ^{J-}	<0.033	1470	<0.3	0.25 ^J
218-HA01S-01	5/3/96	0.5	7.2	333	1.2	<0.1	31.1 ^{J+}	14.2	<0.02	2230	<0.6	0.26
218-HA01S-02	5/3/96	2.5	7.7	460	1.7	<0.15	39.2 ^{J+}	12.8	<0.02	2320	<0.9	0.43 ^J
218-HA01S-03	5/3/96	5	4.4	1110	2	<0.3	13.6 ^{J+}	6.8	<0.02	864 ^J	<1.8	<0.6
218-HA02S-01	4/21/96	0.5	5.8	365	1.4	<0.25	30.3	11	0.03 ^J	1140 ^J	<1.5	<0.5
218-HA02S-02	4/21/96	2.5	3.4	785	1.4	<0.25	9.3	4.5	<0.02	403 ^J	<1.5	<0.5
218-HA02S-03	4/21/96	5	2.7 ^J	532	1.4	<0.25	4.9	3.3	0.033 ^J	<250	<1.5	<0.5
218-HA03S-01	5/3/96	0.5	5.4	422	1.3	<0.1	27.7 ^{J+}	15.4	<0.02	1730	<0.6	0.38 ^J
218-HA03S-02	5/3/96	2.5	7.2	964	1.8	<0.15	44.1 ^{J+}	10.4	<0.02	1490	<0.9	0.53 ^J
218-HA04S-01	4/21/96	2.5	4.1	463	1.5 ^J	<0.25	22.7	7.4 ^J	0.031 ^J	1070 ^J	<1.5	<0.5
218-HA04S-02	4/21/96	5	1.3 ^J	424	1.3	<0.15	8.5	5.7	0.047 ^J	718 ^J	<0.9	<0.3

Table 4-1
Building 218 Metals Results
 (Detections Only) *continued*

Sample ID	Sample Date	Depth	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Chromium, Total	Lead, Total	Mercury, Total	Potassium, Total	Selenium, Total	Silver, Total
		CRQL	0.5	2	0.2	0.2	0.5	0.5	0.2	500	0.5	0.5
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
218-HA05S-01	4/21/96	2.5	4.3	1070	1.5	<0.25	18.7	15.1	0.031 ^J	781 ^J	< 1.5	< 0.5
218-HA05S-02	4/21/96	5	6.6	434	1.7	<0.25	27.3	10.7	0.045 ^J	1100 ^J	< 1.5	< 0.5
218-HA06S-01	4/21/96	2.5	4.1	198	1.2	<0.25	17	13.6	0.024 ^J	928 ^J	< 1.5	< 0.5
218-HA07S-01	4/21/96	2.5	5.5	303	0.85 ^J	<0.25	28.6	15.6 ^J	0.026 ^J	871 ^J	< 1.5	< 0.5
218-HA07S-02	4/21/96	2.5	5	671	1.7	<0.25	18.8	9.5	0.039 ^J	727 ^J	< 1.5	< 0.5
218-SB01S-01	4/30/96	10	3.3	120	2.3	<0.1	21.1 ^{J+}	8.1	<0.02	2560	1.3	0.36 ^U
218-SB02S-01	4/30/96	10	3.1	113	1.5	<0.1	10.1 ^{J+}	5.9	<0.02	1400	1.7	0.86 ^J
218-SB02S-02	4/30/96	15	2.9	30.3	0.86	0.17 ^J	4.9 ^{J+}	3	<0.02	952	< 0.3	0.49 ^U
218-SB03S-01	4/30/96	10	3.6	207	1.3	0.2 ^J	13.4 ^{J+}	6.3	<0.02	1170	1.4	1.5 ^J
218-SB04S-01	4/30/96	10	3.9	116	1.7	0.21 ^J	18.1 ^{J+}	8	<0.02	2330	1.1	0.87 ^J
218-SB04S-02	4/30/96	15	3.2	87.8	1.5	0.22 ^J	7.8 ^{J+}	5.5	<0.02	1460	< 0.6	1.2 ^J
218-SB05S-01	4/30/96	11	5.3	135	1.6	0.22 ^J	20.3 ^{J+}	9.2	<0.02	2760	< 0.6	0.56 ^J
FSSP-SS14S-01	10/24/95	1	8	395	0.71	6.7	69	210	26.9	1830	5.5	54
FSSP-SS15S-01	10/24/95	1	8.7	415	0.84	6.4	70.3	226	31	2190	4.9	51
Analyses			39	39	39	39	39	39	39	39	39	39
Detections			39	39	39	18	39	39	12	38	8	22
Maximum Concentration			8.7	1110	2.3	6.7	70.3	226	31	2760	5.5	54
Arizona HBGL - Nonresidential			3.82	28700	1.34	244	5950	1400	123		2030	2030
Arizona HBGL - Nonresidential Hits			17	0	16	0	0	0	0		0	0
Maximum Background Concentration			44	1610	5	1.5	90	30	0.3	0	0.8	2.6
Background Hits			0	0	0	2	0	9	2	0	6	2

Notes:

CRQL Contract required quantitation limits
 < Less than the indicated detection limit
 Data qualifiers are defined in Appendix H



Legend:

- +++++ Railroad
- 11.70- All concentrations in parts per million (ppm)

Building 218 - Spray Paint Operatic

Lead Concentrations in Surface Soils

Camp Navajo, Bellemont, Arizona

Figure 4-1

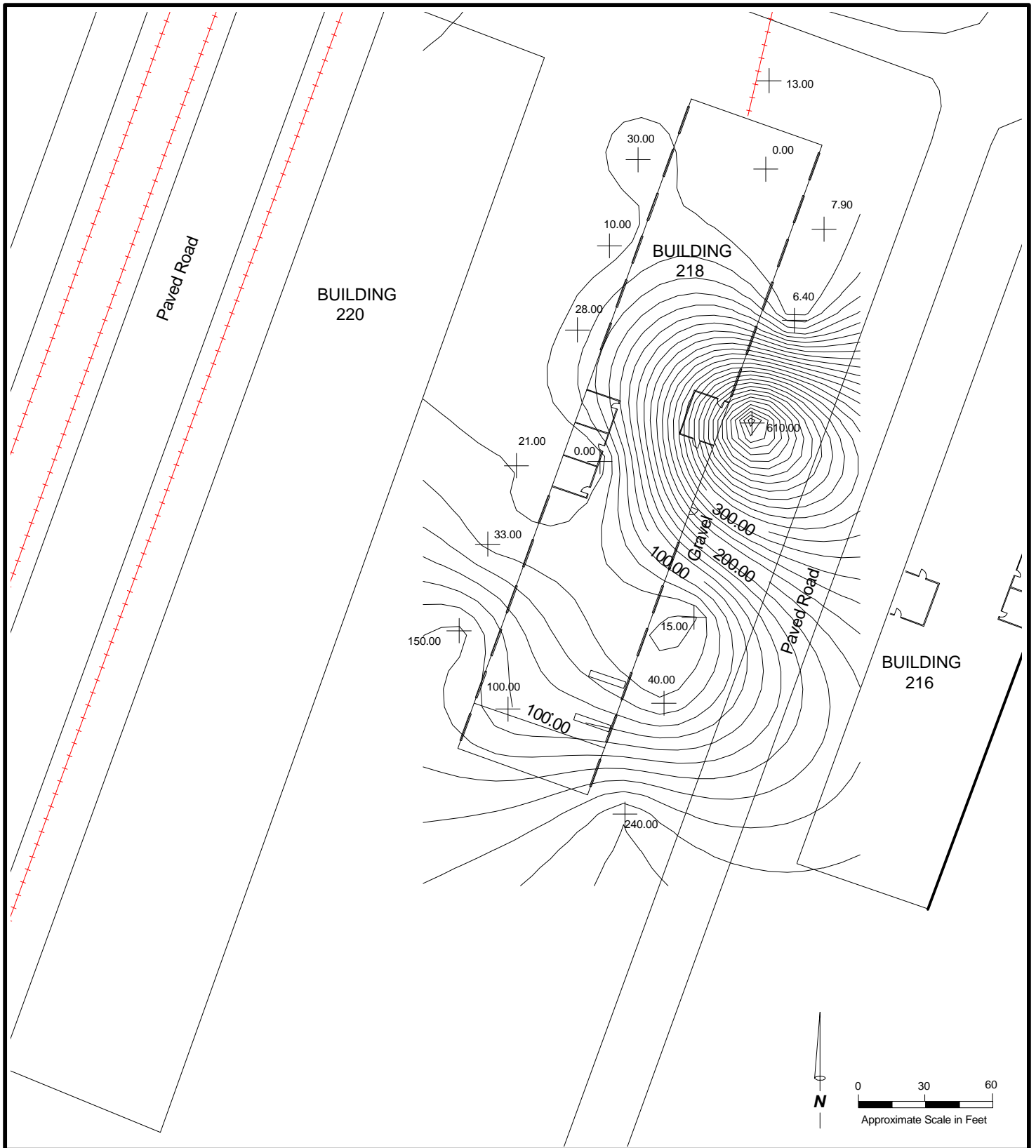
Table 4-2
Building 218 Petroleum Hydrocarbon Results
 (Detections Only)

Sample ID	Sample Date	Depth CRQL Units	TPH, Recoverable mg/kg	Diesel Fuel 2 mg/kg
218-SS01S-01	9/26/95	1	13	< 0
218-SS02S-01	9/26/95	1	7.9 ^J	< 0
218-SS03S-01	9/26/95	1	6.4 ^J	< 0
218-SS04S-01	9/26/95	1	240 ^J	21 ^J
218-SS05S-01	9/26/95	1	15	17 ^J
218-SS06S-01	9/26/95	1	40	< 0
218-SS07S-01	9/26/95	1	240	57 ^J
218-SS08S-01	9/26/95	1	150	15 ^J
218-SS09S-01	9/26/95	1	33	< 0
218-SS10S-01	9/26/95	1	21	< 0
218-SS11S-01	9/26/95	1	28	67 ^J
218-SS12S-01	9/26/95	1	10 ^J	26 ^J
218-SS13S-01	9/26/95	1	20	< 0
218-SS14S-01	9/26/95	1	610 ^J	34 ^J
218-SS15S-01	9/26/95	1	30	< 0
218-HA02S-02	4/21/96	2.5	3.1 ^U	< 0
218-HA02S-03	4/21/96	5	21	< 0
218-HA03S-01	5/3/96	0.5	100	< 0
218-HA03S-02	5/3/96	2.5	1500	8300 ^J
218-HA04S-01	4/21/96	2.5	3.9 ^U	< 0
218-HA04S-02	4/21/96	5	4.2 ^U	< 0
218-HA05S-01	4/21/96	2.5	76 ^J	41 ^J
218-HA05S-02	4/21/96	5	24	81 ^J
218-HA06S-01	4/21/96	2.5	32	< 0
218-HA07S-01	4/21/96	2.5	64 ^J	< 0
218-HA07S-02	4/21/96	2.5	5.5 ^{UJ}	< 0
218-SB03S-01	4/30/96	10	89	330 ^J
Analyses			37	37
Detections			27	11
Maximum Concentration			1500	8300

Arizona HBGL - Nonresidential
 Arizona HBGL - Nonresidential Hits

Notes:

CRQL Contract required quantitation limits
 < Less than the indicated detection limit
 Data qualifiers are defined in Appendix H



Building 218 - Spray Paint Operatic

Petroleum Hydrocarbon Concentrations in Surface

Camp Navajo, Bellemont, Arizona

Figure 4-2

Legend:

- +++++ Railroad
- 1170- All concentrations in parts per million (ppm)

Table 4-3
Building 218 OC Pesticides and PCBs
 (Detections Only)

Sample ID	Sample Date	Depth	Chlorpyrifos	Chlorpyrifos	Chlorpyrifos
		CRQL Units	0.0033 mg/kg	0.0033 mg/kg	0.0033 mg/kg
FSSP-SS14S-01	10/24/95	1	0.18	0.15	0.086 ^J
FSSP-SS15S-01	10/24/95	1	0.13	0.14	0.18 ^J
Analyses			2	2	2
Detections			2	2	2
Maximum Concentration			0.18	0.15	0.18
Arizona HBGL - Nonresidential			23.9	17	17
Arizona HBGL - Nonresidential Hits			0	0	0

Notes:

CRQL Contract required quantitation limits
 < Less than the indicated detection limit
 Data qualifiers are defined in Appendix H

and beryllium were found at concentrations higher than the ADEQ nonresidential HBGLs, but the concentrations are within background ranges previously defined for the installation (Tetra Tech 1997).

Background concentrations were established by statistical analysis of all samples collected at Camp Navajo. Outliers were identified during the analysis and were eliminated from the statistical test prior to determination of the background concentrations (Tetra Tech 1997).

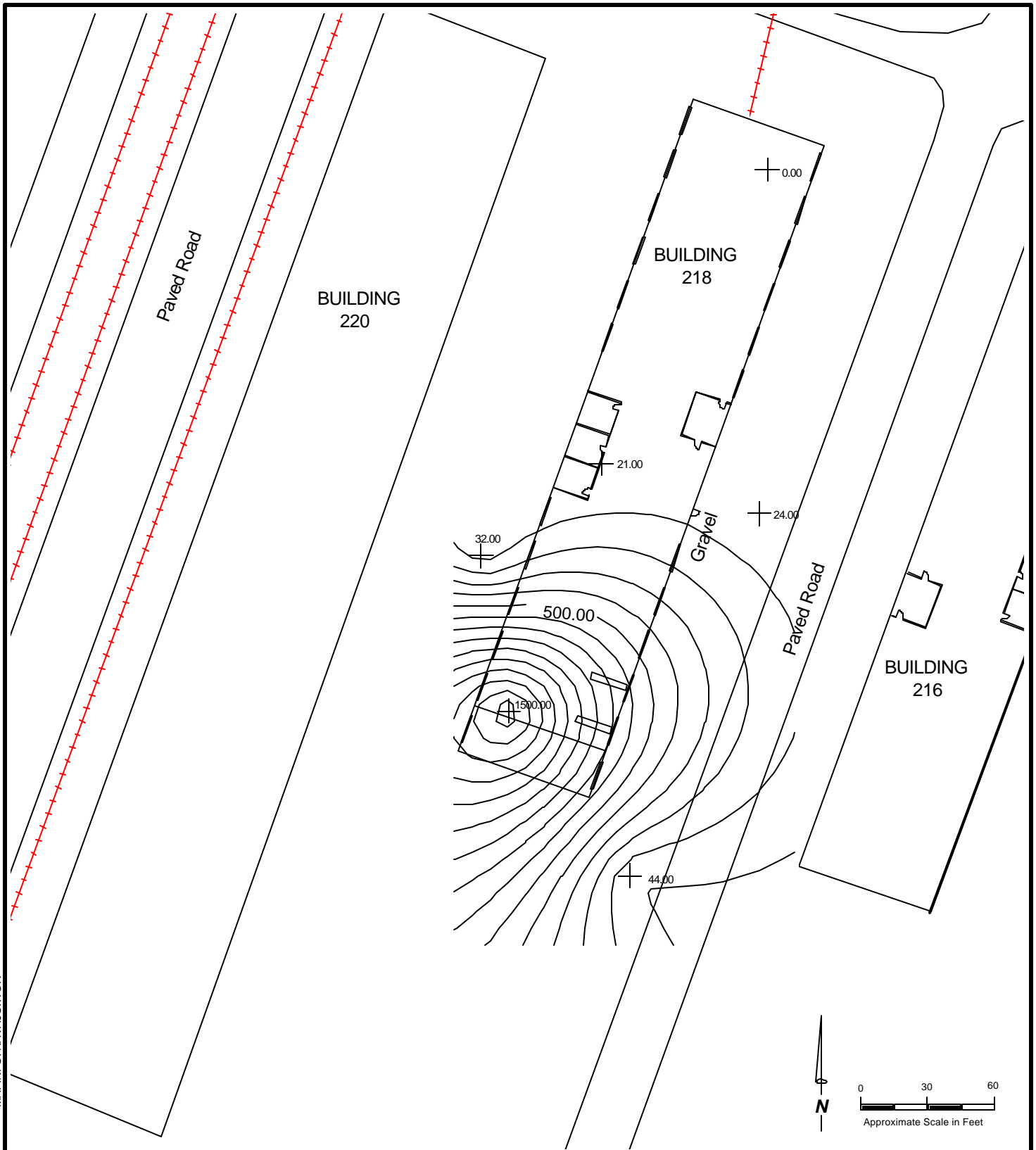
Concentrations of petroleum hydrocarbons were identified in 11 of the subsurface soil samples collected at this site (Table 4-2). Concentrations of TRPH were detected in 11 surface soil samples (up to 1,500 mg/kg) (Figure 4-3). The other detected petroleum hydrocarbon (Diesel Fuel #2) was detected at low concentrations (up to 8,300 mg/kg) and is evaluated in Section 5.

Ten VOCs were identified in subsurface soil samples collected from around and beneath the building (Table 4-4). Six VOCs (ethylbenzene, 1-methylethylbenzene, m- & p-xylene, naphthalene, o-xylene, and toluene) were identified at concentrations below ADEQ nonresidential HBGLs and thus are not considered to be contaminants of concern. The other four detected SVOCs (1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, isopropyltoluene, n-butylbenzene, and npropyl benzene) do not have set HBGLs but were detected at very low concentrations (0.26 mg/kg, 0.0092 mg/kg, 0.015 mg/kg, and 0.038 mg/kg respectively) and are evaluated in Section 5.

Twelve SVOCs were identified in subsurface soil samples collected from around and beneath the building (Table 4-5). Nine SVOCs (naphthalene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)-phthalate, fluoranthene, fluorene, and pyrene) were identified at concentrations below ADEQ nonresidential HBGLs and thus are not considered to be contaminants of concern. The other three detected SVOCs (2-methylnaphthalene, dibenzofuran, and phenanthrene) do not have set HBGLs but were detected at very low concentrations (5.4 mg/kg, 0.3 mg/kg, and 0.9 mg/kg) and are evaluated in Section 5.

4.4. QA/QC

All samples were sent to Quanterra Incorporated (Quanterra) of Santa Ana, California, for inorganic and organic parameter analyses. Custody seals were reported intact for all coolers forwarded to the laboratory, and temperature blanks were within an acceptable range upon receipt, with the exception of the specific instances discussed below. Applicable holding times were met for all analyses. Six field duplicate samples, including one soil boring sample (SB), two shallow subsurface soil samples (HA), and three surface soil samples (SS), were collected at the site during the investigation, as shown below. The latter surface soil duplicate pair was collected directly from the FSSP. Validation of the data was conducted by Laboratory Data Consultants, Inc., (LDC) of Carlsbad, California.



Legend:

- +++++ Railroad
- 1170- All concentrations in parts per million (ppm)

Building 218 - Spray Paint Operatic

Petroleum Hydrocarbon Concentrations in Subsurface

Camp Navajo, Bellemont, Arizona

Table 4-4
Building 218 Volatile Organic Compounds Results
(Detections Only)

Sample ID	Sample Date	Depth	1,3,5- Trimethylbenzene	1,2,4- Trimethylbenzene	Ethylbenzene	1-Methylethylbenzene	Isopropyltoluene	m- & p-Xylene(s)	n-Propyl benzene	Naphthalene	o-Xylene	Toluene
		CRQL Units	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg
218-HA02S-02	4/21/96	2.5	0.00035 ^J	0.00093 ^J	<0.00024	<0.00028	<0.00037	0.0018 ^U	<0.00023	0.0003 ^J	0.00049 ^J	0.00099 ^U
218-HA02S-03	4/21/96	5	0.00032 ^J	0.00058 ^J	<0.00024	<0.00028	<0.00037	< 0.00054	<0.00023	<0.00024	<0.00023	< 0.00025
218-HA03S-02	5/3/96	2.5	0.26 ^{J+}	0.0092 ^{J+}	0.0089 ^{J+}	0.017 ^{J+}	0.15	0.015 ^{J+}	0.038	1	<0.00115	< 0.00125
218-HA04S-02	4/21/96	5	0.00027 ^J	0.00034 ^J	<0.00024	<0.00028	<0.00037	< 0.00054	<0.00023	0.00033 ^J	<0.00023	< 0.00025
218-HA05S-01	4/21/96	2.5	<0.00018	< 0.00023	<0.00024	<0.00028	<0.00037	< 0.00054	<0.00023	0.00035 ^J	<0.00023	< 0.00025
Analyses			13	13	13	13	13	13	13	13	13	13
Detections			4	4	1	1	1	2	1	4	1	1
Maximum Concentration			0.26	0.0092	0.0089	0.017	0.15	0.015	0.038	1	0.00049	0.00099
Arizona HBGL - Nonresidential					42000	16450		805000		16450	805000	80500
Arizona HBGL - Nonresidential Hits					0	0		0		0	0	0

Notes:

CRQL Contract required quantitation limits
< Less than the indicated detection limit
Data qualifiers are defined in Appendix H

Table 4-5
Building 218 Semivolatile Organic Compounds Results
 (Detections Only)

Sample ID	Sample Date	Depth	1,2-Dichlorobenzene	2,4-Dichlorobenzene	1,3-Dichlorobenzene	Benzofuran	Benzonitrile	Benzothiazole	1,2,4-Trichlorobenzene	1,3,5-Trichlorobenzene	1,4-Dichlorobenzene	1,2-Dichloroethane	Phenanthrene	Pyrene
		CRQL	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
218-HA01S-03	5/3/96	5	<0.019	<0.02	<0.021	<0.017	<0.018	<0.017	<0.023	<0.03	0.056 ^J	<0.024	0.045 ^J	0.048 ^J
218-HA03S-02	5/3/96	2.5	1.1	5.4	<0.021	<0.017	<0.018	<0.017	<0.023	0.3 ^J	<0.039	0.73	0.9	<0.026
218-SB03S-01	4/30/96	10	<0.076	<0.08	0.092 ^J	<0.068	<0.072	<0.068	0.15 ^U	<0.12	0.12 ^J	<0.096	0.12 ^J	<0.104
218-SB05S-01	4/30/96	11	<0.019	<0.02	0.039 ^J	0.04 ^J	0.038 ^J	0.057 ^J	0.064 ^U	<0.03	0.11 ^J	<0.024	0.16 ^J	0.093 ^J
Analyses			20	20	20	20	20	20	20	20	20	20	20	20
Detections			1	1	2	1	1	1	2	1	3	1	4	2
Maximum Concentration			1.1	5.4	0.092	0.04	0.038	0.057	0.15	0.3	0.12	0.73	0.9	0.093
Arizona HBGL - Nonresidential			16450		122500	4.6	0.8	4.6	407		16450	16450		12250
Arizona HBGL - Nonresidential Hits			0		0	0	0	0	0		0	0		0

Notes:

CRQL Contract required quantitation limits
 < Less than the indicated detection limit
 Data qualifiers are defined in Appendix H

- 218-SB05S-01 blind duplicate of 218-SB04S-01;
- 218-HA07S-01 blind duplicate of 218-HA04S-01;
- 218-HA07S-02 blind duplicate of 218-HA05S-01;
- 218-SS14S-01 blind duplicate of 218-SS04S-01;
- 218-SS15S-01 blind duplicate of 218-SS13S-01; and
- 218-SS15S-01 (FSSP) blind duplicate of 218-SS14S-01 (FSSP).

General validation findings applicable to both inorganic and organic data resulted in the qualification of select compound concentrations above the method detection limit but below the respective sample quantitation limit prior to dilution and percent moisture corrections. These reported values are considered to be qualitatively acceptable but quantitatively estimated due to uncertainties in analytical precision near the limit of detection. According to USEPA guidelines, however, these low concentration data are considered suitable for risk evaluation with appropriate recognition of the noted quantitative uncertainties.

Soil Gas Screening by Gore-Sorber^a Passive Sorbent Modules

Sorbent modules collected at the site arrived at W.L. Gore Laboratory with a cooler temperature of 9.6°C, approximately four degrees higher than the upper end of Gore's recommended temperature range of 4°C±2°C and one degree higher than the project QC acceptance criterion as applicable to soil and water matrices. Affected data are thus considered as estimated with a potential low bias due to elevated cooler temperatures documented at the time of sample receipt. However, W.L. Gore Laboratory refrigeration requirements for module storage allow an acceptance range of 0°C to 10 °C since sorbent cartridges exclude liquid water and do not permit escape of VOC vapors as long as module tips are maintained intact. Based on the magnitude of departure from recommended temperature guidelines and the meeting of all analytical holding times requirements, effects on data quality are not expected to be significant and soil gas data are considered useable for screening purposes.

Volatile Organic Compounds by USEPA Method 8260A

Evaluation of field duplicate results for the VOC analyses indicated excellent qualitative and quantitative agreement between reported results. All analytical values reported for the field duplicate pairs were below the respective sample quantitation limits; hence, all VOC duplicate results are considered acceptable.

Results of the validation performed by LDC indicated trace toluene and m,p-xylene contamination in several affiliated equipment rinsate samples. Therefore, these compounds were considered to be "system" contaminants impacting VOC data for field sample 218-HA02S-02. Although the concentrations observed in the quality control (QC) blanks were less than the respective sample quantitation limit, corresponding low-level results for toluene and m,p-xylene in the noted subsurface soil sample were qualified as nondetected in Appendix H and were considered to be usable for risk evaluation at adjusted reporting limits.

Validation findings also suggested potential uncertainties in nondetect chloromethane results for subsurface soil samples 218-HA01S-02 and 218-HA01S-03, based on calibration parameters exceeding USEPA data assessment criteria. Although chloromethane has no calibration specifications required by the method and all associated matrix spike/matrix spike duplicate (MS/MSD) and laboratory control sample (LCS) recoveries were within QC acceptance criteria, analytical data for affected samples were flagged as quantitatively estimated in Appendix H. However, the magnitude of any potential quantitative biases would likely be insignificant relative to the respective health-based limits established for this compound. Hence, noted nondetect chloromethane results are considered quantitatively estimated but usable for risk evaluation purposes, according to USEPA guidelines.

In addition, validation indicated the potential for high biases in low-level VOC results for field sample 218-HA03S-02, based on a single surrogate spike recovery (127%) above the upper QC acceptance criteria for accuracy (121%). Analytical results for the noted sample indicated in Appendix H were flagged as quantitatively estimated with a probable high bias. Reanalysis confirmed initial findings, and the deviation was attributed by the laboratory to sample matrix interferences. However, the potential high bias expressed in the surrogate performance would not be expected to impact sample concentrations quantitated significantly below health-based action levels. Although data were qualified as estimated, no significant adverse effects on overall data quality are expected.

All other VOC data for submitted field samples were determined to be valid without qualification and were considered usable for all purposes.

Semivolatile Organic Compounds by USEPA Method 8270B

Evaluation of field duplicate results for the SVOC analyses indicated excellent qualitative and quantitative agreement between reported results. All analytical values reported for the field duplicate pairs were below the respective sample quantitation limits, hence, all SVOC duplicate results are considered acceptable.

Validation results indicated trace bis(2-ethylhexyl)-phthalate contamination in several affiliated equipment rinsate samples. Therefore, this compound was considered to be a “system” contaminant impacting SVOC data for subsurface soil samples 218-SB03S-01 and 218-SB05S-01. Although the concentrations observed in the QC blanks were less than the respective sample quantitation limit, corresponding low-level results for bis(2-ethylhexyl)-phthalate in the noted subsurface soil samples were qualified as nondetected in Appendix H and were considered to be usable for risk evaluation at adjusted reporting limits.

Validation findings also indicated potential uncertainties in nondetect SVOC results for multiple subsurface soil samples, based on calibration parameters exceeding USEPA data assessment criteria. Analytical data for the associated samples indicated in Appendix H were flagged as quantitatively estimated. Affected SVOCs included

1,2-diphenylhydrazine, 2,4-dinitrophenol, 2-naphthylamine, dimethylphenethylamine, benzidine, and bis(2-chloroisopropyl)-ether. Each of these indicated compounds have no calibration specifications required by the method, and all associated MS/MSD and LCS recoveries for the affected samples were within acceptable QC criteria. Moreover, the magnitude of any potential quantitative biases would likely be insignificant relative to the respective health-based limits established for each compound. Hence, applicable nondetect SVOC results are considered quantitatively estimated but usable for risk evaluation purposes, according to USEPA guidelines.

All other SVOC data for submitted field samples were determined to be valid without qualification and were considered usable for all purposes.

Polychlorinated Biphenyls and Organochlorine Pesticides by USEPA Method 8081

Evaluation of field duplicate results for the polychlorinated biphenyl (PCB) and organochlorine (OC) pesticide analyses indicated general quantitative agreement between reported results. A relative percent difference (RPD) was outside of QC acceptance criteria for 4,4-DDT in the field duplicates pair 218-SS14S-01 (FSSP) and 218-SS15S-01 (FSSP). This reported incident of imprecision may be attributable to both matrix interferences and sample heterogeneity in the sewage sludge pile. Although USEPA guidelines for organic data assessment do not require qualification of data on the basis of field duplicate precision alone, 4,4-DDT results for the indicated samples were flagged as quantitatively estimated in Appendix H. However, the potential uncertainties would not be expected to impact sample concentrations quantitated significantly below health-based action levels. Although 4,4-DDT data were qualified as estimated, no restrictions on data usability for risk evaluation applications are expected.

All other PCB and OC pesticide data for submitted samples were determined to be valid without qualification and were considered usable for all purposes.

Total Extractable Petroleum Hydrocarbons by ADHS Method BLS-191

Evaluation of field duplicate results for the total extractable petroleum hydrocarbon (TEPH) analyses indicated general quantitative agreement between reported results. An RPD was outside of QC acceptance criteria for TEPH in the field duplicates pair 218-HA05S-01 and 218-HA07S-02. This reported incident of imprecision may be attributable to the high clay content and typical heterogeneity of soils in the Camp Navajo area. Although USEPA guidelines for organic data assessment do not require qualification of data on the basis of field duplicate precision alone, TEPH results for the indicated samples were flagged as quantitatively estimated in Appendix H. However, the potential uncertainties would not be expected to impact TEPH concentrations quantitated significantly below health-based action levels. Although results were qualified as estimated, no restrictions on data usability for risk evaluation applications are expected.

Validation of TEPH results for all field samples indicated qualitative uncertainties of the reported hydrocarbon species. Quantification of reported TEPH results was accomplished using diesel fuel reference standards since the chromatographic profiles obtained from sample analyses were not consistent with patterns observed from known hydrocarbon reference standards. Due to both the default application of diesel fuel response factors and the high degree of uncertainty in the petroleum hydrocarbon identifications, the resulting TEPH values are considered quantitatively estimated and are reported as “unknown hydrocarbons.”

All other TEPH data for submitted samples were determined to be valid without qualification and were considered usable for all purposes.

Total Recoverable Petroleum Hydrocarbons by ADHS Method BLS-418.1AZ

Evaluation of field duplicate results for TRPH analyses indicated general quantitative agreement between reported results. RPDs were outside of QC acceptance criteria for TRPH in field duplicate pairs 218-SS04S-01 and 218-SS14S-01, 218-HA04S-01 and 218-HA07S-01, and 218-HA05S-01 and 218-HA07S-02. These reported incidents of imprecision may be attributable to the high clay content and typical heterogeneity of soils in the Camp Navajo area. Although USEPA guidelines for organic data assessment do not require qualification of data on the basis of field duplicate precision alone, TRPH results for the samples indicated above were flagged as quantitatively estimated in Appendix H. However, the potential uncertainties would not be expected to impact TRPH concentrations quantitated significantly below health-based action levels. Although results were qualified as estimated, no restrictions on data usability for risk evaluation applications are expected.

Results of the validation also indicated trace TRPH contamination in select analytical method blanks. Therefore, these nonspecified petroleum hydrocarbons were considered to be a laboratory contaminant impacting TRPH data for the field samples 218-HA02S-02, 218-HA04S-01, 218-HA04S-02, and 218-HA07S-02. Although the concentrations observed in the method blanks were less than one-half of the respective sample quantitation limits, low-level TRPH results in the subsurface soil samples indicated above were qualified as nondetected in Appendix H and were considered to be usable for risk evaluation purposes at an adjusted reporting limit.

All other TRPH data for submitted samples were determined to be valid without qualification and were considered usable for all purposes.

Metals by USEPA Methods 6010A and 7471A

Evaluation of field duplicate results for the metals analyses indicated general qualitative and quantitative agreement between reported results for the ten target elements. All RPDs were within QC acceptance criteria with exception of beryllium and lead in the field duplicate samples 218-HA04S-01 and 218-HA07S-01. These incidents of imprecision may be attributable to the high clay content and typical

heterogeneity of soils in the Camp Navajo area. Although USEPA guidelines for inorganic data assessment do not require qualification of data on the basis of field duplicate precision alone, associated results for the indicated samples were flagged as quantitatively estimated in Appendix H. However, no restrictions on data usability for risk evaluation applications are expected.

Validation findings suggested the potential for high biases in chromium results for multiple subsurface soil samples based on an MS recovery (138%) above the upper QC acceptance criterion for accuracy (125%). Analytical results for the associated field samples indicated in Appendix H were flagged as quantitatively estimated with a probable high bias. These deviations were attributed to sample matrix interferences by the laboratory. However, potential high biases expressed in the MS performance would not be expected to impact chromium concentrations quantitated significantly below health-based action levels. According to USEPA guidelines, data are both qualified as estimated and considered usable for risk evaluation.

Validation also indicated the potential for low biases in chromium and lead results for all surface soil samples based on MS recoveries (69% and 54%, respectively) below the lower QC acceptance criterion for accuracy (75%). Reanalysis confirmed the initial results and affected metals data for the associated field samples indicated in Appendix H were flagged as quantitatively estimated with a probable low bias. Moreover, all LCS recoveries were acceptable and the MS deviations were attributed to sample matrix interferences by the laboratory. Since concentrations for both elements in affected samples were significantly below health-based action levels, data are considered usable for risk evaluation purposes, with an appropriate recognition of the noted quantitative uncertainties.

Supplemental validation findings indicated trace cadmium and silver contamination in several calibration and preparation blanks. Therefore, these elements were considered to be laboratory contaminants impacting metals data for the field samples indicated below:

- Cadmium in samples 218-SS04S-01, 218-SS09S-01, 218-SS10S-01, 218-SS11S-01, 218-SS13S-01, and 218-SS15S-01; and,
- Silver in samples 218-SB01S-01 and 218-SB02S-02.

Although the concentrations observed in the QC samples were less than one-half of the respective sample quantitation limits, low level cadmium and silver results indicated in Appendix H for the above-noted field samples were qualified as nondetected and were considered to be usable for risk evaluation purposes at the adjusted reporting limits.

All other metals data for submitted samples were determined to be valid without qualification and were considered usable for all purposes.

Inorganic Nitrogen Parameters by USEPA Methods 353.2 and 350.3

All inorganic nitrogen parameter data for submitted field samples were determined to be valid without qualification and were considered usable for all purposes.

SECTION 5

CONTAMINANT FATE AND TRANSPORT

Section 4 discussed the potential contaminants of concern for the Building 218 site soils. In the surficial soils, lead was found above the maximum background level. In the surface and subsurface soils, the industrial HBGLs for arsenic and beryllium were exceeded. Ground water samples were not collected. This section provides a summary of the contaminants potential routes of migration, their ability to persist in the environment, and the relative migration potential for these contaminants of concern.

5.1. POTENTIAL ROUTES OF MIGRATION

Organic and inorganic compounds in soils have the same potential routes of migration. The contaminants can become dissolved in infiltrating precipitation and can be transported vertically downward. This process can be quite rapid where near-vertical open channels, such as solution planes or fractures, exist. Overland routes of migration include transport by wind as particulates or excavation and transport by human beings or animals.

5.2. CONTAMINANT PERSISTENCE

As elements, lead, arsenic and beryllium cannot be further degraded. In subsurface environments elemental metals often form silicate, carbonate, and sulfate precipitates. The rate of deposition is controlled primarily by site-specific pH-redox conditions.

5.3. CONTAMINANT MIGRATION

The rate of metals migration in saturated and unsaturated soils is strongly influenced by adsorption processes, particularly where cationic metals are sorbed onto soil particle imperfections with negative electrical charges. The cation exchange capacity (CEC) represents the total number of negatively charged sites in a given amount of solid at which adsorption and desorption can occur. Clays, such as those at the Building 218 site, commonly have high CECs. It is expected that adsorption will severely retard the movement of metals contaminants. The fact that subsurface soils did not have elevated concentrations of lead indicates that significant downward migration of metals contaminants is not occurring. In addition, in the pH ranges

common to ground water flow systems, metals transport in ground water is limited by their low solubilities.

SECTION 6

RISK SCREENING

Current activities and activity patterns at the site are considered part-time commercial/industrial, as are the documented land uses surrounding the site. Therefore, for purposes of this risk screening, land use of the site is assumed to be industrial. Previous operations at the site have indicated inorganic metal compounds, VOCs, SVOCs, PCBs, OC pesticides and petroleum hydrocarbons to be the principal chemicals of concern (COCs) posing a potential exposure risk to workers involved in commercial/industrial activities.

Inorganic Contaminants

Based on maximum reported soil and sewage sludge pile concentrations, the only metals with detectable levels greater than the corresponding HBGLs developed by the Arizona Department of Health Services (ADHS) for ADEQ using nonresidential exposure assumptions were arsenic and beryllium. Potassium was eliminated from the risk screening, based on its relative low toxicity and because its maximum reported concentration was less than the USEPA “ceiling limit” of 1×10^{-5} mg/kg reserved for “less toxic inorganic contaminants.”

Maximum concentrations for arsenic in both soils (7.7 mg/kg) and the sludge pile (8.7 mg/kg) were observed to exceed the current HBGL for nonresidential soils (3.82 mg/kg), as well as the current USEPA Region IX Preliminary Remediation Goal (PRG) for industrial soils (2.4 mg/kg). Maximum concentrations for beryllium (2.3 mg/kg) were observed to exceed the current HBGL (1.34 mg/kg) and PRG (1.1 mg/kg) in soil samples only. However, from a quantitative risk screening perspective, using USEPA “total risk” criteria, reported metals concentrations in soils and the sludge pile are considered to reside within an acceptable range of both health-based standards under expected part-time occupational exposure conditions.

In addition, maximum soil and sludge pile concentrations of arsenic and beryllium were below naturally occurring background levels recorded for the geographical area encompassing Camp Navajo. Background concentration levels of 44 mg/kg for

arsenic and 5.0 mg/kg for beryllium (Tetra Tech 1997) indicate that the reported soil and sludge pile results are consistent with regional conditions. According to both USEPA and USACE guidelines, if inorganic chemicals are detected at the site at naturally occurring concentrations, they may be eliminated from the corresponding risk evaluation.

Organic Contaminants

Laboratory results for the organic COCs show that maximum soil concentrations are below current nonresidential HBGLs in all situations where HBGLs have been established. Consequently, VOCs, SVOCs, PCBs, OC pesticides and petroleum hydrocarbons were excluded as COCs since they were not indicated to be present at concentrations high enough to pose a potential exposure or health threat during on-site commercial/industrial operations, using ADEQ and USEPA guidelines.

The four VOCs with detectable trace concentrations but no currently promulgated HBGLs or PRGs are all alkylated benzenes, a hydrocarbon group that includes isopropyltoluene and the trimethylbenzenes. The maximum reported soil concentration for this group of VOCs was 0.26 mg/kg for 1,3,5-trimethylbenzene. Results for the other VOCs without current HBGLs were also in the sub-part per million (sub-ppm) range with low frequencies of detection. Because the maximum concentrations for these VOCs were all considerably less than the current nonresidential HBGL established for benzene (197 mg/kg), a member of this chemical class but with significantly higher volatilization and toxicological properties, trace VOC levels for the four reported alkylated benzenes would not be expected to constitute a health hazard in a commercial/industrial setting. In addition, all related alkylated benzene compounds with established HBGLs on the VOC target list were within regulated limits.

The two polynuclear aromatic hydrocarbons (PAHs) with reported trace concentrations but no current HBGLs or PRGs were 2-methyl naphthalene and phenanthrene. The maximum reported soil concentration for this group of SVOCs was 0.9 mg/kg for phenanthrene, and both compounds had relatively low frequencies of detection. Because the maximum concentrations for these SVOCs are essentially equivalent to the current nonresidential HBGL established for benzo(a)pyrene (0.8 mg/kg), a PAH with significantly higher toxicological properties and the standard for comparative toxicity among carcinogenic PAHs, according to USEPA, trace levels of 2-methyl naphthalene and phenanthrene would not be expected to constitute a health hazard to part-time on-site commercial/industrial activities, using this relative risk-based guidance. In addition, all related PAH compounds with established HBGLs on the SVOC target list were within regulated limits.

Although there are no nonresidential HBGLs developed for dibenzofuran, its maximum concentration (0.3 mg/kg) reported for soils on-site was found to be significantly less than the PRG (140 mg/kg) established by USEPA for industrial soils. Therefore, this compound also is not indicated to be present at concentrations high

enough to pose a potential exposure or health threat during on-site commercial/industrial activities, using USEPA guidelines.

Petroleum hydrocarbon data reported for surface and subsurface soil samples revealed generalized, low level concentrations consistent with historical maintenance and repair operations at the site. There were no TPRH concentrations reported above the respective nonresidential HBGL (7,000 mg/kg). For the TEPH analyses, a method without HBGLs established, the maximum reported concentrations were 67 mg/kg for surface soils and 8,300 mg/kg for subsurface soils. Only four of the twenty-two subsurface soils tested had detectable petroleum hydrocarbon contamination and all TEPH results greater than the respective sample quantitation limit were reported by the laboratory as “unknown hydrocarbons.” No soil samples had detectable diesel fuel concentrations. Since USEPA and USACE guidelines require chemical-specific data in deriving estimates of potential health risks, TRPH and TEPH data from the site present qualitative evidence of low level hydrocarbon contamination at concentrations not expected to be health adverse.

6.1. RISK ASSESSMENT SUMMARY

A group-wide risk assessment for Group B-3 including a quantitative evaluation of the Building 218, was prepared in January 1998 (Tetra Tech 1999c). The results of the risk assessment concurred with the risk screening above. No excess carcinogenic risks ($>10^{-6}$) were identified in relation to surface soils or near surface soils. No evaluated noncarcinogenic hazard indices (>1) were identified in relation to surface soils or near surface soils. There is no primary contributor to carcinogenic risks and noncarcinogenic hazard indices in surface and near-surface soils. The ecological risk action level for a selected wildlife indicator species was not exceeded.

SECTION 7

SUMMARY AND CONCLUSIONS

7.1. SUMMARY

No contamination has been identified above action levels at either Building 218 or the FSSP. Detected concentrations of contaminants do not exceed either health based guidance levels or risk based concentrations of concern.

Risk evaluation results indicate that the maximum reported concentrations of identified contaminants in surface and subsurface soils at the site would not be expected to result in adverse health effects relevant to commercial/industrial land use. However, because the detected metals, arsenic and beryllium, are classified as potential carcinogens, which are usually subject to quantitative risk models to determine exact exposure conditions when detected at elevated levels, physical access to the site should be restricted and general efforts should be taken to reduce the potential and duration of any occupational exposure.

7.2. CONCLUSIONS

Workers performing on-site commercial/industrial activities and who come into contact with surface and subsurface soils should wear dermal and inhalation protection appropriate to the task. The determination in this report incorporate the most current ADHS, USEPA, and USACE “acceptable” target risk criteria into its approach and are intended to be a “health-conservative” evaluation of potential risk and hazard.

All data collected during this investigation meet QA/QC standards and are considered to be representative of site conditions. Therefore, based on the lack of detected contamination exceeding either HBGLs or risk screening levels, no further action is warranted. Tetra Tech recommends the site be considered for closure by ADEQ.

SECTION 8

REFERENCES

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- _____. 1992. *Guidance for Data Useability: Parts A and B Final Report (PB92-963356)*. April 1992.
- _____. 1996. *Preliminary Remediation Goals (PRGs)*. Region IX. August 1996.

APPENDIX A

PHOTO DOCUMENTATION

- 4-20 Bldg. 218, 7/23/94, S., by Brad Hall
- 9-6 Purging of PCB-contaminated water from the hydraulic lift (Bldg. 218), 9/23/94, E., by John Bock
- 14-23 Empty drums in storage container, 10/28/94, W., by Tom Whitehead
- 16-3 Demolition of Bldg. 218 east lift pit walls, view from doorway, SE, 5/19/96, by David Wrzosek
- 17-2 Sampling bottom soil from Sump 2 out of backhoe bucket, E, 11/3/94, by Tom Whitehead
- 17-10 Sump 2 (middle ground) and Sump 1 (background) before steam cleaning floor, 11/4/94, NE, by Tom Whitehead
- 17-13 Bldg. 218 line of pipes, 8/9/94, SW, by Mary Bork
- 17-14 Bldg. 205 looking at location of old pump location, 8/9/94, N, by Mary Bork
- 17-15 More pipe from Bldg. 205 to under cement crane, NW, by Mary Bork
- 17-16 Fill pipe under cement crane, 8/994, NW, by Mary Bork
- 17-23 Floor of south end of Bldg. 218 after steam cleaning; Sumps 1 and 2 in background, 11/4/94, E., by Tom Whitehead
- 18-2 Former PCB soil stockpile in 240 area, fence in place, from south end, 11/8/94, N, by William Bicknell
- 27-23 Three unlabeled black drums at south end of building, 6/5/95, S., by Dave Wrzosek
- 27-24 Recent remediation excavation at SW end of Bldg 218, 6/5/95, E., by Dave Wrzosek
- 28-1 South end of 218 from mid building, S, 6/5/95, by Dave Wrzosek
- 28-2 North side of 218 from mid building, N., 6/5/95, by Dave Wrzosek
- 39-21 Wayne patching hole @ Bldg 218, W, 11/19/95, by Dave Wrzosek
- 39-22 Patched hole @ Bldg 218, 11/19/95, by Dave Wrzosek











3 12:48



4 10:29











4 13:56





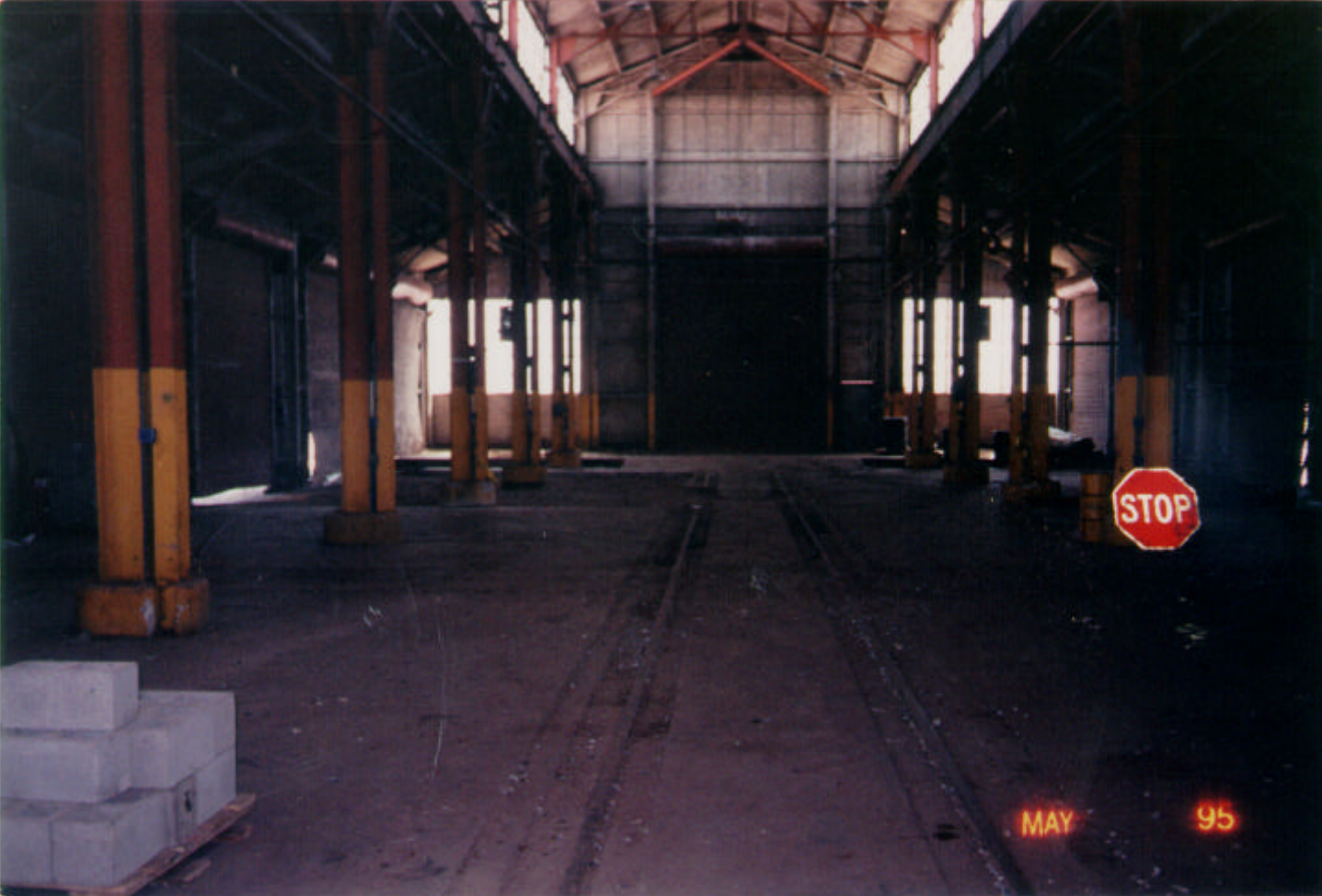
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APPENDIX B

FIELD NOTES

APPENDIX C

STANDARD OPERATING PROCEDURES

SECTION 1

PASSIVE SOIL GAS SURVEY

1.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures for conducting a passive soil gas survey. Soil gas will be used as a reconnaissance screening tool to identify volatile and semivolatile contaminants in subsurface soils. Such contaminants migrate at different rates through porous media depending on the permeability of the media, the concentration gradient, and the moisture content. Soil gas can be used to determine the presence and distribution of volatile and semivolatile contaminants. Relatively high concentrations of volatile constituents in the soil atmosphere does not necessarily indicate the presence of similarly high levels of contaminants in the liquid or solid phase, however.

1.2 TECHNIQUE - DESCRIPTION

Soil-gas samplers will be located as described in the site-specific sampling plans. Both deterministic and probabilistic sampling methods will be employed, depending on site-specific conditions and objectives. Probabilistic sampling will be used in areas in which there is little or no information to inform the sampling effort and where potential sampling locations are not constrained. Probabilistic sampling will be based on systematic sampling of a hexagonal grid. The sampling grid may be stratified to focus on certain portions of the site where greater detail is needed. Deterministic sampling will be carried out at sites where there is enough information available to limit the soil gas study to selected portions of the site or where site features limit the choice of sampling locations. For example, soil gas surveys around buildings may be confined to locations between the building perimeter and the adjacent railroad track in order to preferentially sample the area where most spills are likely to have occurred.

1.2.1 Description of Methods

The “passive” soil gas method refers to a sorbent-filled sampler that is installed in the shallow subsurface for a specified time to allow the surrounding vapor-filled atmosphere to migrate into the sampler and be partitioned to the sorbent. The

sampler does not rely on pumping soil vapor into the sampler or through a canister. The sampler is made of a semi-permeable membrane that repels water but allows vapor molecules to enter by diffusion. The sorbent inside the sampler has a high solid-vapor partitioning coefficient and a high sorption capacity such that the concentration gradient is in the direction of the screening module.

The depth of installation of soil gas probes will be three feet below the ground surface to identify evidence of contaminants that originated primarily from surface spills. Deeper installations may be justified if the source of the contamination is below a capping layer that would hinder detection of the contaminant at the three-foot depth.

As vapor diffuses in the soil atmosphere, it enters the sampler and sorbs strongly to the sorbent. The concentration of contaminant molecules in the soil atmosphere is a function of the volatility of the compound, the concentration of the compound in the liquid or solid phase, temperature, humidity, and, to some extent, the concentrations of other compounds.

The sorbent mixture absorbs almost all volatile and semivolatile organic compounds. If the compounds are present in the liquid or solid phase, then equilibrium partitioning between phases ensures that at least some contaminant molecules will be present in the soil atmosphere and will inevitably migrate toward, and be trapped on, the sorbent in the sampler.

1.3 PROCEDURES

1.3.1 Underground Utility Clearance

Prior to selecting sample locations, an underground utility search is recommended. The local utility companies can be contacted and requested to mark the locations of their underground lines. Sampling plans can then be drawn up accordingly. Each sample location should also be screened with a metal detector or magnetometer to verify that no underground pipes or drums exist.

1.3.2 Method and Equipment

GORE-SORBERsm

GORE-SORBERsm screening modules will be used for soil gas testing. The screening modules are made of a semi-permeable membrane that repels water but allows vapor molecules to enter by diffusion. The sorbent inside the sampler has a high solid-vapor partitioning coefficient and a high sorption capacity such that the concentration gradient is in the direction of the screening module. The sampling person marks a location on the ground using a flag or spray paint and uses a slide hammer and a tile probe or an electric drill to make a one-inch hole to a depth of two to three feet. While wearing clean nitrile gloves, the sampler removes the module from its sealed container. The module is then lowered into the hole with a stainless steel rod inserted into the pocket in the bottom of the module. Replicate sorbers are housed in the bottom of an length of sealed PTFE tubing. The module is placed to the bottom of

the hole. When the module is inserted the full depth of the hole, it is pressed against the side of the hole and the rod twisted until the rod is freed and pulled out. A cork attached to the top of the module is inserted into the hole to prevent rain or atmospheric gases from entering the module and to facilitate retrieval. The auger and stainless steel rod are decontaminated as described in the Decontamination of Field Equipment SOP.

The modules are left in the ground for 14 days and then are retrieved for analysis.

The outer length of tubing is used to insert and retrieve the module. To retrieve the module, the stopper and module are pulled out of the ground. The stopper then is cut off and discarded.

The sampling person records the following information in the field logbook:

- The unique serial number on the top of the sorber container and on a metal identification tag connected to the screening module;
- The depth of the installation;
- The location identification number;
- The date and time, remarks or observations; and
- The sampler's initials.

The sampling person fills out a field tracking form when the sample is collected. The sorber container tag number, the location number, the depth, date and time of collection, number of replicates, remarks, and observations are recorded on the form. The sampling person relinquishes the samples by signing and dating the form, and the field sample control manager signs to accept the samples. The field sample control manager then transfers the information on the field sample tracking report form to a chain-of-custody form and enters the analytical methods requested.

1.3.3 Sample Containers and Preservation Techniques

The module and metal tag identification are to be placed back into the labeled vial which is then sealed. The samples are packed in a cooler containing ice at a temperature of 4°C and shipped to the laboratory.

1.3.4 Field Quality Control Sampling Procedures

There are no specific quality assurance activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior and after sampling/operation and they must be documented.

1.3.5 Decontamination Procedures

All sampling equipment will be properly decontaminated as outlined in the SOP for Decontamination of Field Equipment.

SECTION 2

SURFACE-SOIL SAMPLING

2.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures for collecting representative surface samples. Analysis of surface samples can determine whether concentrations of specific surface pollutants exceed established action levels, and if the concentrations of soil pollutants present a risk to public health, welfare, or the environment.

Materials exposed on the land surface, including soils, sediments, and wastes, are subject to disturbance by weather conditions, vehicle traffic, bioturbation, and other effects. Because volatile contaminants are unlikely to be present in surficial materials, it generally is not necessary to obtain undisturbed samples from the surface. An exception to is when surface samples are collected from beneath an impermeable surface, such as a road or building slab. Surface soils are typically very heterogeneous in compositions and texture, and chemical concentrations in surface soils may vary dramatically over short depth intervals. Often, the first few inches of soil contain gravel, vegetation, or debris. It is desirable to use a sampling method that reduces the impacts of these heterogeneities without biasing the results.

For surface-soil sampling, some judgment may be needed to identify the ground surface datum. The objective is to sample the soil matrix and avoid collecting rock and plant material to the extent possible. Vegetation will be moved aside, dense vegetative matting, detritus or roots will be removed, and gravel will be scraped away to expose the ground surface. Surface samples from beneath pavement or concrete slabs will be collected after first removing road base and gravel to expose the underlying soil. In some locations, such as in the basements of buildings, the ground surface will be below grade. In these cases, depth below grade will be measured and recorded.

2.2 TECHNIQUE - DESCRIPTION

Soil samples may be collected using a variety of methods and equipment. The methods and equipment used are dependent on the type of sample required (disturbed versus undisturbed) and the type of soil. Samples that do not need to be undisturbed may be easily sampled using a spade, trowel, or scoop. Collecting undisturbed samples may be performed using a hand-auger, a trier, or a split-spoon sampler.

2.3 PROCEDURES

2.3.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.
2. Obtain necessary sampling and air monitoring equipment.
3. Decontaminate or preclean equipment, and ensure that it is in working order.
4. Prepare schedules, and coordinate with staff, client, and regulatory agencies as appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Use stakes, buoys, or flagging to identify and mark all sampling locations. Consider specific site factors, including extent and nature of contaminant, when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. The property owner prior to soil sampling will clear all staked locations for underground utilities.

2.3.2 Interferences and Potential Problems

There are two primary interferences or potential problems associated with soil sampling. These are cross-contamination of samples and improper sample collection methods. Cross-contamination can be eliminated or minimized through the use of sampling equipment dedicated to each sample location. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection methods include using contaminated sampling equipment, disturbing of the matrix causing in compaction of the sample, or inadequate homogenizing of the samples where required, which results in variable, non-representative analytical results.

2.3.3 Sampling Considerations

This method can be used in most soil types. Surface soil samples may be collected with spades, shovels, or scoops. Surface material can be removed to the required

depth with this equipment, then a stainless steel or plastic scoop can be used to collect the sample.

Accurate, representative samples can be collected with this procedure depending on the care and precision taken. A flat, pointed mason trowel can be used to cut a block of the desired soil when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most other cases. Avoid the use of devices plated with chrome or other materials. Plating is particularly common with garden implements such as potting trowels.

Follow these procedures to collect surface-soil samples.

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
3. If the sample is to be analyzed for volatile organics, volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless-steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then, place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly.

2.3.4 Sample Containers and Preservation Techniques

In order to ensure proper sample preservation, samples should be refrigerated to 9°C or less and holding time should be kept to a minimum.

2.3.5 Field Quality Control Sampling Procedures

There are no specific quality-assurance activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior and after sampling/operation and they must be documented.

2.3.6 Decontamination Procedures

All sample equipment that comes into contact with soil or water must be decontaminated prior to sampling. Decontamination procedures for sampling equipment are described in the Decontamination of Field Equipment SOP.

SECTION 3

SHALLOW SUBSURFACE-SOIL SAMPLING

3.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures for collecting representative shallow subsurface soil samples. Analysis of shallow subsurface samples can determine whether concentrations of specific subsurface pollutants exceed established action levels, and if the concentrations of soil pollutants present a risk to public health, welfare, or the environment.

Because volatile contaminants are likely to be present in subsurface materials, it generally is necessary to obtain undisturbed samples from the subsurface. Subsurface soils are typically very heterogeneous in compositions and texture, and chemical concentrations in subsurface soils may vary dramatically over short depth intervals.

3.2 TECHNIQUE - DESCRIPTION

Subsurface soil samples may be collected using a variety of methods and equipment. The methods and equipment used are dependent on the depth of the desired sample, the type of sample required (disturbed versus undisturbed), and the type of soil. Near-surface soils may be easily sampled using a spade, trowel, or scoop. Sampling at greater depths may be performed using a hand-auger, a trier, a split-spoon sampler, or, if required, a backhoe.

3.3 PROCEDURES

3.3.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.
2. Obtain necessary sampling and air monitoring equipment.
3. Decontaminate or preclean equipment, and ensure that it is in working order.

4. Prepare schedules, and coordinate with staff, client, and regulatory agencies as appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Use stakes, buoys, or flagging to identify and mark all sampling locations. Consider specific site factors, including extent and nature of contaminant, when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. The property owner prior to soil sampling will clear all staked locations for underground utilities.

3.3.2 Interferences and Potential Problems

There are two primary interferences or potential problems associated with subsurface soil sampling. These are cross-contamination of samples and improper sample collection methods. Cross-contamination can be eliminated or minimized through the use of sampling equipment dedicated to each sample location. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection methods include using contaminated sampling equipment, disturbing of the matrix causing in compaction of the sample, or inadequate homogenizing of the samples where required, which results in variable, non-representative analytical results.

3.3.3 Sampling Considerations

Sampling at Depth with Augers and Thin-Wall Tube Samplers

This system consists of an auger, a series of handle extensions to allow sampling at depth, a “T” handle, and a thin-wall tube sampler. The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin-wall tube sampler. The sampler is then lowered down the borehole and driven into the soil at the completion depth. The sampler is then withdrawn and the core removed.

Several types of augers are available. These include: bucket, continuous flight (screw), and posthole augers. Bucket augers are better for direct sample recovery since they can remove a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the auger flights. Sampling from continuous flight augers is satisfactory when a composite of the complete soil column is desired. Posthole augers have limited utility for sample collection.

Follow these procedures for collecting subsurface soil samples with the auger and a thin-wall tube sampler.

1. Attach the auger bit to a drill rod extension, and attach the “T” handle to the drill.
2. Clear the area to be sampled of any surface debris (e.g. twigs, rocks, litter). It may be advisable to remove the first 3 to 6 inches of surface soil for an area approximately 6 inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This helps prevent accidental brushing of loose material back down the borehole when removing the auger or adding extensions. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from boring. When sampling directly from the auger, collect sample after the auger is removed from boring and proceed to step 10.
5. Remove auger tip from drill rods and replace with a pre-cleaned thin-wall tube sampler. Install proper cutting tip.
6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler, and unscrew the drill rods.
8. Remove the cutting tip and the core from the device.
9. Discard the top of the core (approximately 1 inch), as this represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container(s). Sample homogenization is not required.
10. If volatile organic analysis is to be performed, transfer portions of the sample directly into an appropriate, labeled container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then, place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly.
11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.

12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

Sampling at Depth with a Trier

The system consists of a trier, and a “T” handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

Follow these procedures to collect subsurface soil samples with a sampling trier.

1. Insert the trier into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.
2. Rotate the trier once or twice to cut a core of material.
3. Slowly withdraw the trier, making sure that the slot is facing upward.
4. If volatile organic analysis is to be performed, transfer portions of the sample directly into an appropriate, labeled container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then, place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly.

Sampling at Depth with a Split-Spoon Sampler

The procedure for split-spoon sampling describes the collection and extraction of undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augered hole and the core extracted.

When split-tube sampling is performed to gain geologic information, all work should be performed in accordance with ASTM D 1586-84.

Follow these procedures for collecting subsurface soil samples with a split spoon.

1. Assemble the sampler by aligning both sides of the barrel and then screwing the bit onto the bottom and the heavier head piece onto the top.
2. Place the sampler in a perpendicular position on the sample material.
3. Using a sledgehammer or well ring, if available, drive the tube. Do not drive past the bottom of the head piece or compression of the sample will result.

4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.
5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half longitudinally. The split-spoon sampler typically is available in diameters of 2 and 3 1/2 inches. A larger barrel may be required to obtain the required sample volume.
6. Without disturbing the core, transfer it to an appropriate labeled sample container(s) and seal tightly.

3.3.4 Sample Containers and Preservation Techniques

In order to ensure proper sample preservation, samples should be refrigerated to 9°C or less and holding time should be kept to a minimum.

3.3.5 Field Quality Control Sampling Procedures

There are no specific quality-assurance activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior and after sampling/operation and they must be documented.

3.3.6 Decontamination Procedures

All sample equipment that comes into contact with soil or water must be decontaminated prior to sampling. Decontamination procedures for sampling equipment are described in the Decontamination of Field Equipment SOP.

SECTION 4

HOLLOW STEM AUGER DRILLING AND BOREHOLE SAMPLING

4.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures and to establish the guidelines for hollow-stem auger (HSA) drilling (soil borings, wells, or piezometers) and formation sampling activities in unconsolidated formations. Formation (sediment/soil) sample collection include disturbed (drill cuttings), intact (split-spoon), and undisturbed (continuous core). Borehole abandonment (closure) procedures will also be addressed in this SOP.

The objective of drilling is to collect accurate subsurface information including lithological and chemical data. If the borehole is to be prepared for potential completion as a well or piezometer, the lithologic data is the most important information that can be collected. The lithologic data characterizes subsurface conditions, describes hydrogeologic coefficients qualitatively and/or quantitatively, and identifies optimum locations for screen zones if wells are constructed.

Data can be obtained through the physical examination and testing of formation samples, as well as knowledge regarding ground water levels. Thus, drill fluid mix, fluid loss, rate of drilling, lengths of split-spoon and continuous core recovery, etc. must be monitored and recorded by the on-site hydrogeologist or geologist.

4.2 TECHNIQUE - DESCRIPTION

Subsurface sampling is an intrusive activity that requires underground utility clearance at all sites and Unexploded Ordnance (UXO) clearance at sites where UXO may be present prior to performing the sampling. UXO clearance is described in the unexploded ordnance operations SOP, and utility clearance is described in the Line Locating SOP.

Drilling rigs will be used for obtaining soil samples from boreholes deeper than five feet. The drilling method will depend on the target depth and the hydrogeologic conditions in the subsurface.

A geologist with a minimum of three years experience in environmental drilling and sampling will supervise each drilling rig. All drilling operations and well installations will be conducted under the supervision of a registered geologist.

The geologist will verify that the drilling technique is the one specified in the investigation work plan, and that the drilling equipment mobilized by the driller is in good condition and proper working order. The driller will not be permitted to use a drilling rig that appears to be substandard, in disrepair, etc. possibly incapable of accomplishing the goals of the drilling program.

The hollow stem auger (HSA) method is the most commonly used drilling method for unconsolidated formations. HSA augers consist of continuous flights welded to a large-diameter pipe with a cutter head mounted at the bottom. Drill rods can pass through the hollow center (hollow stems) of the auger. During drilling, a center plug and pilot bit is inserted into the bottom of the pipe to prevent soil from coming up inside the augers.

For sampling, the plug and pilot bit are pulled up through the augers and a sampling device is lowered through the auger in its place. The augers act as a temporary casing to prevent caving and sloughing of the borehole walls.

This drilling method is rapid and extremely effective in most cohesive sediments, but is somewhat less effective in loose sandy material. Maximum penetration depth depends on soil conditions, the diameter of the auger flight, and the power of the drill rig; depths up to 250 feet bgs have been achieved under compatible conditions. A major advantage of this technique is that no fluids are introduced into the formation under normal conditions. If the auger flights can be removed and the integrity of the borehole maintained, electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run in the open borehole. If the auger flights must remain in the borehole, only radiation geophysical logs can be run through the auger flights. Well casing, screen, and sampling devices can be lowered through the hollow stem after removal of the center plug and pilot bit at the bottom of the auger flights, and filter packing and sealing of a well can be accomplished through the hollow stem. Auger flight outside diameters (OD) can range from five inches to 12 inches. The diameter of a well that can be constructed inside the hollow stem is limited to a maximum of approximately four inches.

Advantages of using the hollow stem auger drilling method are the following:

1. Soil samples can be collected from different strata during drilling;

2. It has the least potential for cross-contamination between strata of the common drilling techniques;
3. A large-diameter borehole may be drilled in which multiple wells can be installed; and
4. Less well development is generally needed than in mud rotary because of the relatively large diameter borehole, the ability to emplace a large and effective filter pack, and because no drilling fluids are introduced into the borehole.

Disadvantages include:

1. Very slow progress or refusal in coarse materials such as cobbles and boulders;
2. Cannot drill hard rock formations and is generally not suited for wells deeper than 100 feet;
3. Not good in caving formations; and
4. Potential for disturbing large volume of subsurface materials around the borehole; therefore affecting local permeabilities and creating annular channels for contaminant movement between different strata.

4.3 PROCEDURES

4.3.1 Preparation

The planning, selection, and implementation of any drilling program should include the following steps.

1. Review existing data on site geology and hydrogeology including publications, air photos, water-quality data, and existing maps. These may be obtained from local, state, or federal agencies.
2. Visit the site to determine field geologic conditions and potential access problems for the drilling rig, to establish water supply, and to delineate drill equipment and materials storage area.
3. Prepare site safety and health plan.
4. Define project objectives, and select drilling and sampling methods.
5. Determine need for containing drill cuttings or fluids and their disposal.
6. Prepare work plan including all of the above.

7. Prepare and execute the drilling contract.
8. Implement drilling program.
9. Prepare the final report, including background data, project objective, field procedures, and boring logs.

4.3.2 Field Preparation

1. Prior to the mobilization of the drilling rig, thoroughly decontaminate the rig and all associated equipment to remove all oil, grease, mud, etc.
2. Before drilling each boring, steam-clean and rinse all the down hole drill equipment with potable water to minimize cross-contamination as described in the Decontamination of Field Equipment SOP. Special attention should be given to the thread section of the casings and drill rods. All drilling equipment should be steam-cleaned at completion of the project to ensure that no contamination is transported to or from the sampling site.

4.3.3 Drilling

1. Because drilling is an intrusive activity, a utility clearance must be completed prior to conducting any drilling to assure that no underground utilities may be encountered during drilling.
2. Document all drilling-related activities (e.g., starting, stopping, footage, problems, decontamination, etc.) on the daily log form and in the field notebook. Record dates and times of activities and names of personnel providing oversight.
3. Monitor and record speed of rotation, rate of drilling, and length of drill rods or casing in the borehole.
4. Confirm that the drill rods and core barrel are straight, or discontinue drilling.
5. Pay particular attention to the advancement of the boring because differences in the rate of drilling may be indicative of differences in the subsurface geologic conditions (e.g., sand and gravel versus clay).
6. Maintain a continuous dialogue with the driller to track and keep informed of all drilling activities (e.g., the speed of the drill and drilling pressure, difficult and easy drilling conditions, etc.).
7. Collect formation samples as described below in Section 1.3.4. Sample containers must be labeled properly with project number and name, site location, boring number, date, sample interval, and samplers initials.

8. Record geologic information on the boring log form and in the field notebook.
9. Handle and ship sample containers carefully to avoid breakage and disturbance.

4.3.4 Downhole Sampling Methods

Subsurface soil samples will be obtained using a variety of techniques, depending on the target depth and type of subsurface materials encountered. The preferred downhole sampling method will be continuous coring. When it works well, it allows observation of stratigraphic relations with minimum down time. Five-foot intervals can be cored at one time versus only 18-inch to two-foot intervals using split-spoon sampling, the other sampling option. Continuous split spoon sampling may be used, however, if adequate recoveries cannot be obtained by coring. Adequate recovery for continuous core and split spoon sampling will be defined as at least 80 percent recovery.

Prior to sampling, all equipment that comes into contact with the soil or water will be fully decontaminated as described in the SOP for Decontamination of Field Equipment.

Continuous Core Sampling

1. For continuous core sampling where volatile analyses are required, the sampler will be fitted with ten 6-inch long stainless steel liners. At locations where volatile analysis are not required, no stainless steel liners are required to be inserted into the core barrel.
2. The core barrel is attached to the drilling rods and advanced with the augers. After the drill rods have been advanced five feet, the core barrel is retrieved and opened, and the liners are removed.
3. As the liners are separated, an photoionization detector (PID) or flame ionization detector (FID) probe will be inserted into the gap between two liners, and the liner exhibiting the highest reading will be selected for analysis. In general, the middle liner will be collected for laboratory analysis.
4. Half of the soil in the top liner will be placed into a resealable plastic bag and left in the sun for approximately fifteen minutes to allow VOCs to volatilize. The soil vapor in the plastic bag head space will then be tested with a PID or FID. Background VOCs in the plastic bag will be determined by testing the head space in an empty bag. Results of the organic vapor screening will be recorded on the boring logs.
5. Soils in the liners will be logged before they are sealed if VOCs are not contaminants of concern. If VOCs are an analyte, the sample liner will immediately be sealed, and soils from adjacent liners will be logged. Small portions of soil at the ends of the liners will be scraped off and classified. The

area where the sampler is opened will be swept clear of soil between successive openings of the split spoon samplers.

6. The liners collected for laboratory analysis will be covered at both ends with Teflon sheets, capped, and sealed with cohesive tape. Adhesive tape will not be used.
7. Labels will be affixed to the liners bearing job designation, time, boring number, sample depth interval, sample number, sample date, and the initials of the sampling personnel.
8. The samples will be enclosed in a plastic bag and stored in a cooler maintained at 4°C prior to shipment.

Split-Spoon Sampling

Split-spoon sampling will be executed following American Society for Testing and Materials (ASTM) D1586-84 Standard Method for Penetration Test and Split-barrel Sampling of Soils. Relatively undisturbed samples from known depths can be obtained using this method.

1. The drilling rods holding the bottom plug in place are withdrawn from the borehole, the plug and pilot bit removed, and the split-spoon sampler attached and lowered into the hole. The 18-inch long split-spoon sampler will be fitted with three stainless steel liners.
2. The sampler will be driven 18 inches or to refusal with a 140-pound hammer dropping 30 inches repeatedly. The number of blows required to drive the sampler every six inches will be recorded. Refusal will be defined as requiring 50 blows with the hammer to advance the sampler six inches or less.
3. Once the sampler is retrieved, the split spoon can be opened and the sample liner removed.
4. From this point on all procedures are similar to those described in continuous core sampling (numbers 3 through 9).

4.3.5 Borehole Abandonment or Closure

1. To prevent contamination of clean soil or ground water by contaminated materials on the surface or penetrated by the boring, the borehole will be backfilled to the surface with a cement/bentonite grout. The grout will be tremmied into the hole through the augers.
2. Once the grout has set up, the surface of the borehole will be covered with material of the original ground surface. A temporary wooden survey stake will be

used to mark the boring location, and the boring number marked on the stake for subsequent surveying of the borehole location.

3. For each abandoned borehole, the procedure will be documented on an appropriate field form or in the study notebook. Documentation may include borehole designation, location, depth of borehole, copy of the geologic log, date of grouting, water level prior to grouting, any other state or local well abandonment reporting requirements.

4.3.6 Field Quality Control Sampling Procedures

There are no specific quality assurance activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior and after sampling/operation and they must be documented.

4.3.7 Field Quality Control Sampling Procedures

All sample equipment that comes into contact with soil and/or water must be decontaminated prior to sampling. Decontamination procedures for sampling equipment are described in the Decontamination of Field Equipment SOP.

APPENDIX D

GEOPHYSICAL SURVEY

APPENDIX E

SOIL BORING LOGS

APPENDIX F

SURVEYOR RESULTS

Survey

SiteID	PTID	Northing	Easting	Elevation
218	SG01	28728.87	19742	
218	SG02	28708.66	19800.2	
218	SG03	28649.2	19781.88	
218	SG04	28590.65	19761.15	
218	SG05	28533.7	19739.75	
218	SG06	28475.72	19716.87	
218	SG07	28418.26	19696.96	
218	SG08	28356.75	19673.14	
218	SG09	28300.55	19653.06	
218	SG10	28242.83	19630.86	
218	SG11	28393.77	19663.17	
218	SG12	28342.27	19637.62	
218	SG13	28287.53	19611.75	
218	SG14	28383.55	19626.08	
218	SG15	28324.64	19600.59	
218	SG16	28269.84	19579.62	
218	SG17	28422.17	19601.06	
218	SG18	28365.75	19581.14	
218	SG19	28307.2	19567.14	
218	SG20	28482.31	19621.23	
218	SG21	28540.28	19643.11	
218	SG22	28595.53	19661.36	
218	SG23	28655.72	19681.23	
218	SG24	28718.29	19702.79	
218	SG25	28450.29	19648.05	
218	SG26	28468.49	19682.67	
218	SG27	28507.85	19668.46	
218	SG28	28527.2	19705.04	
218	SG29	28565.83	19687.73	
218	SG30	28583.37	19721.38	
218	SG31	28622.51	19706.92	
218	SG32	28639.44	19740.05	
218	SG33	28674.67	19728.78	
218	SG34	28696.24	19762.61	
218	SS01	28733.75	19761.51	
218	SS02	28667.63	19785.97	
218	SS03	28627.06	19772.81	
218	SS04	28581.26	19753.97	
218	SS05	28494.77	19728.13	
218	SS06	28456.54	19714.71	
218	SS07	28407.15	19697.33	
218	SS08	28488.81	19623.51	
218	SS09	28527.34	19636.25	
218	SS10	28562.27	19649.04	
218	SS11	28622.77	19676.23	
218	SS12	28660.21	19690.45	
218	SS13	28698.51	19703.21	
218	HA01	28694.36	19760.04	
218	HA02	28564.11	19686.17	

Survey

SiteID	PTID	Northing	Easting	Elevation
218	HA03	28453.93	19645.22	
218	HA04	28380.97	19698.97	
218	HA05	28541.86	19756.39	
218	HA06	28522.89	19632.78	

APPENDIX G

SOIL GAS RESULTS

APPENDIX H
ANALYTICAL RESULTS TABLE

Description of Qualifiers

J	Data are considered quantitatively estimated.
J+	Data are considered quantitatively estimated with a possible high bias.
J-	Data are considered quantitatively estimated with a possible low bias.
N	Data are considered quantitatively presumptive due to tentative analyte identification.
NJ	Data are considered quantitatively presumptive due to tentative analyte identification; the associated value is considered quantitatively estimated.
R	Data are rejected and considered unusable for all purposes.
U	Analyte is considered not present above the level of the associated value.
UJ	Analyte is considered not present above the level of the associated value; the associated value is considered quantitatively estimated.
UJ-	Analyte is considered not present above the level of the associated value; the associated value is considered quantitatively estimated with a possible low bias.

Building 218
Remediation Parameters

Sample ID	Sample Date	Depth	pH	Percent Water	Redox Potential	Total Organic Carbon
		CRQL Units	0 PH UNITS	0 PERCENT	0 mV	0.025 PERCENT
218-SS01S-01	9/26/95	1	8.9	3.8	NA	NA
218-SS02S-01	9/26/95	1	9.4	3.9	NA	NA
218-SS03S-01	9/26/95	1	9.6	4.4	NA	NA
218-SS04S-01	9/26/95	1	9.3	9.8	290	0.61
218-SS05S-01	9/26/95	1	9.3	7.8	NA	NA
218-SS06S-01	9/26/95	1	9.4	7.6	NA	NA
218-SS07S-01	9/26/95	1	8.1	7.3	NA	NA
218-SS08S-01	9/26/95	1	8.4	11	NA	NA
218-SS09S-01	9/26/95	1	8.2	11	NA	NA
218-SS10S-01	9/26/95	1	8.4	11	NA	NA
218-SS11S-01	9/26/95	1	8.2	5.7	NA	NA
218-SS12S-01	9/26/95	1	9.3	6.9	NA	NA
218-SS13S-01	9/26/95	1	9.1	8.6	290	0.51
218-SS14S-01	9/26/95	1	9.1	11	NA	NA
218-SS15S-01	9/26/95	1	9.2	8.2	NA	NA
218-HA01S-01	5/3/96	0.5	7.2	21	NA	NA
218-HA01S-02	5/3/96	2.5	7.2	20	NA	NA
218-HA01S-03	5/3/96	5	7.2	29	NA	NA
218-HA02S-01	4/21/96	0.5	7.6	21	NA	NA
218-HA02S-02	4/21/96	2.5	7.6	21	NA	NA
218-HA02S-03	4/21/96	5	7.7	22	NA	NA
218-HA03S-01	5/3/96	0.5	7.6	22	NA	NA
218-HA03S-02	5/3/96	2.5	6.9	26	NA	NA
218-HA04S-01	4/21/96	2.5	7.9	26	263	0.26 ^J
218-HA04S-02	4/21/96	5	7.8	21	NA	NA
218-HA05S-01	4/21/96	2.5	7.7	26	247	0.4
218-HA05S-02	4/21/96	5	7.8	25	NA	NA
218-HA06S-01	4/21/96	2.5	7.9	10	NA	NA
218-HA07S-01	4/21/96	2.5	7.2	17	253	0.73 ^J
218-HA07S-02	4/21/96	2.5	8.1	29	264	0.25
218-SB01S-01	4/30/96	10	8.4	17	NA	NA
218-SB02S-01	4/30/96	10	8.6	14	NA	NA
218-SB02S-02	4/30/96	15	8.6	14	NA	NA
218-SB03S-01	4/30/96	10	8.1	19	NA	NA
218-SB04S-01	4/30/96	10	8.4	8.8	NA	NA
218-SB04S-02	4/30/96	15	8.1	17	NA	NA
218-SB05S-01	4/30/96	11	8.5	15	NA	NA
FSSP-SS14S-01	10/24/95	1	NA	30	410	12.6
FSSP-SS15S-01	10/24/95	1	NA	33	410	14.3

Building 218
Metals

Sample ID	Sample Date	Depth	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Chromium, Total	Lead, Total	Mercury, Total	Potassium, Total	Selenium, Total	Silver, Total
		CRQL Units	0.5 mg/kg	2 mg/kg	0.2 mg/kg	0.2 mg/kg	0.5 mg/kg	0.5 mg/kg	0.2 mg/kg	500 mg/kg	0.5 mg/kg	0.5 mg/kg
218-SS01S-01	9/26/95	1	0.95	127	0.38	0.39	26.6 ^{J-}	64.6 ^{J-}	<0.033	1290	<0.3	0.16 ^J
218-SS02S-01	9/26/95	1	5.6	33.1	0.35 ^J	<0.1	12.4 ^{J-}	23.3 ^{J-}	<0.033	1270	<0.6	<0.2
218-SS03S-01	9/26/95	1	3.2	37.4	0.28	<0.05	11 ^{J-}	58.4 ^{J-}	<0.033	1030	0.52 ^J	<0.1
218-SS04S-01	9/26/95	1	1.2	70.1	0.45	0.32 ^U	9.1 ^{J-}	24.9 ^{J-}	<0.1	890	<0.3	<0.1
218-SS05S-01	9/26/95	1	2.7	108	0.41	<0.05	13.9 ^{J-}	3.3 ^{J-}	<0.033	1390	<0.3	<0.1
218-SS06S-01	9/26/95	1	2	101	0.43	<0.05	11.2 ^{J-}	10.7 ^{J-}	<0.033	1110	<0.3	<0.1
218-SS07S-01	9/26/95	1	0.93	81	0.38	0.56	17.2 ^{J-}	45.9 ^{J-}	0.11 ^J	975	<0.3	0.14 ^J
218-SS08S-01	9/26/95	1	1.9	217	1.1	0.41	19.2 ^{J-}	18.7 ^{J-}	<0.033	1460	<0.3	0.25 ^J
218-SS09S-01	9/26/95	1	1.9	316	1.4	0.25 ^U	22.7 ^{J-}	18.1 ^{J-}	<0.033	1800	<0.3	0.29 ^J
218-SS10S-01	9/26/95	1	2.5	326	1.3	0.12 ^U	18.1 ^{J-}	16.2 ^{J-}	<0.033	1490	<0.3	0.24 ^J
218-SS11S-01	9/26/95	1	2	190	0.69	0.21 ^U	16.6 ^{J-}	50.3 ^{J-}	<0.033	895	<0.3	0.21 ^J
218-SS12S-01	9/26/95	1	1.7	119	0.6	0.49	16.1 ^{J-}	54.6 ^{J-}	<0.033	1060	0.34 ^J	0.24 ^J
218-SS13S-01	9/26/95	1	2.6	293	0.82	0.28 ^U	14.5 ^{J-}	59.5 ^{J-}	<0.1	1310	<0.3	0.24 ^J
218-SS14S-01	9/26/95	1	1.1	85.2	0.46	0.45	9.3 ^{J-}	21.3 ^{J-}	<0.033	838	<0.3	<0.1
218-SS15S-01	9/26/95	1	2.2	218	0.79	0.32 ^U	17.2 ^{J-}	154 ^{J-}	<0.033	1470	<0.3	0.25 ^J
218-HA01S-01	5/3/96	0.5	7.2	333	1.2	<0.1	31.1 ^{J+}	14.2	<0.02	2230	<0.6	0.26
218-HA01S-02	5/3/96	2.5	7.7	460	1.7	<0.15	39.2 ^{J+}	12.8	<0.02	2320	<0.9	0.43 ^J
218-HA01S-03	5/3/96	5	4.4	1110	2	<0.3	13.6 ^{J+}	6.8	<0.02	864 ^J	<1.8	<0.6
218-HA02S-01	4/21/96	0.5	5.8	365	1.4	<0.25	30.3	11	0.03 ^J	1140 ^J	<1.5	<0.5
218-HA02S-02	4/21/96	2.5	3.4	785	1.4	<0.25	9.3	4.5	<0.02	403 ^J	<1.5	<0.5
218-HA02S-03	4/21/96	5	2.7 ^J	532	1.4	<0.25	4.9	3.3	0.033 ^J	<250	<1.5	<0.5
218-HA03S-01	5/3/96	0.5	5.4	422	1.3	<0.1	27.7 ^{J+}	15.4	<0.02	1730	<0.6	0.38 ^J
218-HA03S-02	5/3/96	2.5	7.2	964	1.8	<0.15	44.1 ^{J+}	10.4	<0.02	1490	<0.9	0.53 ^J
218-HA04S-01	4/21/96	2.5	4.1	463	1.5 ^J	<0.25	22.7	7.4 ^J	0.031 ^J	1070 ^J	<1.5	<0.5
218-HA04S-02	4/21/96	5	1.3 ^J	424	1.3	<0.15	8.5	5.7	0.047 ^J	718 ^J	<0.9	<0.3
218-HA05S-01	4/21/96	2.5	4.3	1070	1.5	<0.25	18.7	15.1	0.031 ^J	781 ^J	<1.5	<0.5
218-HA05S-02	4/21/96	5	6.6	434	1.7	<0.25	27.3	10.7	0.045 ^J	1100 ^J	<1.5	<0.5
218-HA06S-01	4/21/96	2.5	4.1	198	1.2	<0.25	17	13.6	0.024 ^J	928 ^J	<1.5	<0.5

Building 218
Metals

Sample ID	Sample Date	Depth	Arsenic, Total	Barium, Total	Beryllium, Total	Cadmium, Total	Chromium, Total	Lead, Total	Mercury, Total	Potassium, Total	Selenium, Total	Silver, Total
		CRQL Units	0.5 mg/kg	2 mg/kg	0.2 mg/kg	0.2 mg/kg	0.5 mg/kg	0.5 mg/kg	0.2 mg/kg	500 mg/kg	0.5 mg/kg	0.5 mg/kg
218-HA07S-01	4/21/96	2.5	5.5	303	0.85 ^J	<0.25	28.6	15.6 ^J	0.026 ^J	871 ^J	<1.5	<0.5
218-HA07S-02	4/21/96	2.5	5	671	1.7	<0.25	18.8	9.5	0.039 ^J	727 ^J	<1.5	<0.5
218-SB01S-01	4/30/96	10	3.3	120	2.3	<0.1	21.1 ^{J+}	8.1	<0.02	2560	1.3	0.36 ^U
218-SB02S-01	4/30/96	10	3.1	113	1.5	<0.1	10.1 ^{J+}	5.9	<0.02	1400	1.7	0.86 ^J
218-SB02S-02	4/30/96	15	2.9	30.3	0.86	0.17 ^J	4.9 ^{J+}	3	<0.02	952	<0.3	0.49 ^U
218-SB03S-01	4/30/96	10	3.6	207	1.3	0.2 ^J	13.4 ^{J+}	6.3	<0.02	1170	1.4	1.5 ^J
218-SB04S-01	4/30/96	10	3.9	116	1.7	0.21 ^J	18.1 ^{J+}	8	<0.02	2330	1.1	0.87 ^J
218-SB04S-02	4/30/96	15	3.2	87.8	1.5	0.22 ^J	7.8 ^{J+}	5.5	<0.02	1460	<0.6	1.2 ^J
218-SB05S-01	4/30/96	11	5.3	135	1.6	0.22 ^J	20.3 ^{J+}	9.2	<0.02	2760	<0.6	0.56 ^J
FSSP-SS14S-01	10/24/95	1	8	395	0.71	6.7	69	210	26.9	1830	5.5	54
FSSP-SS15S-01	10/24/95	1	8.7	415	0.84	6.4	70.3	226	31	2190	4.9	51

Analyses	39	39	39	39	39	39	39	39	39	39
Detections	39	39	39	18	39	39	12	38	8	22
Maximum Concentration	8.7	1110	2.3	6.7	70.3	226	31	2760	5.5	54
Arizona HBGL - Nonresidential	3.82	28700	1.34	244	5950	1400	123		2030	2030
Arizona HBGL - Nonresidential Hits	17	0	16	0	0	0	0		0	0
Maximum Background Concentration	44	1610	5	1.5	90	30	0.3	0	0.8	2.6
Background Hits	0	0	0	2	0	9	2	0	6	2

Building 218
Petroleum Hydrocarbons

Sample ID	Sample Date	Depth	TPH, Recoverable	Diesel Fuel 2
		CRQL Units	10 mg/kg	10 mg/kg
218-SS01S-01	9/26/95	1	13	<0
218-SS02S-01	9/26/95	1	7.9 ^J	<0
218-SS03S-01	9/26/95	1	6.4 ^J	<0
218-SS04S-01	9/26/95	1	240 ^J	21 ^J
218-SS05S-01	9/26/95	1	15	17 ^J
218-SS06S-01	9/26/95	1	40	<0
218-SS07S-01	9/26/95	1	240	57 ^J
218-SS08S-01	9/26/95	1	150	15 ^J
218-SS09S-01	9/26/95	1	33	<0
218-SS10S-01	9/26/95	1	21	<0
218-SS11S-01	9/26/95	1	28	67 ^J
218-SS12S-01	9/26/95	1	10 ^J	26 ^J
218-SS13S-01	9/26/95	1	20	<0
218-SS14S-01	9/26/95	1	610 ^J	34 ^J
218-SS15S-01	9/26/95	1	30	<0
218-HA01S-01	5/3/96	0.5	<2	<0
218-HA01S-02	5/3/96	2.5	<2	<0
218-HA01S-03	5/3/96	5	<2	<0
218-HA02S-01	4/21/96	0.5	<2	<0
218-HA02S-02	4/21/96	2.5	3.1 ^U	<0
218-HA02S-03	4/21/96	5	21	<0
218-HA03S-01	5/3/96	0.5	100	<0
218-HA03S-02	5/3/96	2.5	1500	8300 ^J
218-HA04S-01	4/21/96	2.5	3.9 ^U	<0
218-HA04S-02	4/21/96	5	4.2 ^U	<0
218-HA05S-01	4/21/96	2.5	76 ^J	41 ^J
218-HA05S-02	4/21/96	5	24	81 ^J
218-HA06S-01	4/21/96	2.5	32	<0
218-HA07S-01	4/21/96	2.5	64 ^J	<0
218-HA07S-02	4/21/96	2.5	5.5 ^{UJ}	<0
218-SB01S-01	4/30/96	10	<2	<0
218-SB02S-01	4/30/96	10	<2	<0
218-SB02S-02	4/30/96	15	<2	<0
218-SB03S-01	4/30/96	10	89	330 ^J
218-SB04S-01	4/30/96	10	<2	<0
218-SB04S-02	4/30/96	15	<2	<0
218-SB05S-01	4/30/96	11	<2	<0

Analyses	37	37
Detections	27	11
Maximum Concentration	1500	8300

Arizona HBGL - Nonresidential
Arizona HBGL - Nonresidential Hits

Building 218
Volatile Organic Compounds

Sample ID	Sample Date	Depth	1,2-Dibromoethane (EDB)	1,2-Dichlorobenzene	1,2-Dichloroethane	1,2-Dichloropropane	1,3,5-Trimethylbenzene	1,3-Dichlorobenzene	1,3-Dichloropropane	1,4-Dichlorobenzene
		CRQL Units	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg
218-HA01S-02	5/3/96	2.5	<0.00031	<0.00025	<0.00019	<0.0004	<0.00018	<0.00034	<0.00022	<0.00021
218-HA01S-03	5/3/96	5	<0.00031	<0.00025	<0.00019	<0.0004	<0.00018	<0.00034	<0.00022	<0.00021
218-HA02S-02	4/21/96	2.5	<0.00031	<0.00025	<0.00019	<0.0004	0.00035 ^J	<0.00034	<0.00022	<0.00021
218-HA02S-03	4/21/96	5	<0.00031	<0.00025	<0.00019	<0.0004	0.00032 ^J	<0.00034	<0.00022	<0.00021
218-HA03S-01	5/3/96	0.5	<0.00031	<0.00025	<0.00019	<0.0004	<0.00018	<0.00034	<0.00022	<0.00021
218-HA03S-02	5/3/96	2.5	<0.00155	<0.00125	<0.00095	<0.002	0.26 ^{J+}	<0.0017	<0.0011	<0.00105
218-HA04S-01	4/21/96	2.5	<0.00031	<0.00025	<0.00019	<0.0004	<0.00018	<0.00034	<0.00022	<0.00021
218-HA04S-02	4/21/96	5	<0.00031	<0.00025	<0.00019	<0.0004	0.00027 ^J	<0.00034	<0.00022	<0.00021
218-HA05S-01	4/21/96	2.5	<0.00031	<0.00025	<0.00019	<0.0004	<0.00018	<0.00034	<0.00022	<0.00021
218-HA05S-02	4/21/96	5	<0.00031	<0.00025	<0.00019	<0.0004	<0.00018	<0.00034	<0.00022	<0.00021
218-HA06S-01	4/21/96	2.5	<0.00031	<0.00025	<0.00019	<0.0004	<0.00018	<0.00034	<0.00022	<0.00021
218-HA07S-01	4/21/96	2.5	<0.00031	<0.00025	<0.00019	<0.0004	<0.00018	<0.00034	<0.00022	<0.00021
218-HA07S-02	4/21/96	2.5	<0.00031	<0.00025	<0.00019	<0.0004	<0.00018	<0.00034	<0.00022	<0.00021

Analyses	13	13	13	13	13	13	13	13	13
Detections	0	0	0	0	4	0	0	0	0
Maximum Concentration	0	0	0	0	0.26	0	0	0	0
Arizona HBGL - Nonresidential	0.08	38500	63	84		35000			200
Arizona HBGL - Nonresidential Hit	0	0	0	0		0			0

Building 218
Volatile Organic Compounds

Sample ID	Sample Date	Depth	2,2-Dichloropropane	2-Chlorotoluene	4-Chlorotoluene	Benzene	Bromobenzene	Bromochloromethane	Bromodichloromethane	Bromoform	1,1,1,2-Tetrachloroethane
		CRQL Units	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.01 mg/kg	0.005 mg/kg
218-HA01S-02	5/3/96	2.5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016
218-HA01S-03	5/3/96	5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016
218-HA02S-02	4/21/96	2.5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016
218-HA02S-03	4/21/96	5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016
218-HA03S-01	5/3/96	0.5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016
218-HA03S-02	5/3/96	2.5	<0.0046	<0.003	<0.0017	<0.0016	<0.0015	<0.00255	<0.0013	<0.000495	<0.0008
218-HA04S-01	4/21/96	2.5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016
218-HA04S-02	4/21/96	5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016
218-HA05S-01	4/21/96	2.5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016
218-HA05S-02	4/21/96	5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016
218-HA06S-01	4/21/96	2.5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016
218-HA07S-01	4/21/96	2.5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016
218-HA07S-02	4/21/96	2.5	<0.00092	<0.0006	<0.00034	<0.00032	<0.0003	<0.00051	<0.00026	<0.000099	<0.00016

Analyses	13	13	13	13	13	13	13	13	13	13
Detections	0	0	0	0	0	0	0	0	0	0
Maximum Concentration	0	0	0	0	0	0	0	0	0	0
Arizona HBGL - Nonresidential		8050		197				92	714	182
Arizona HBGL - Nonresidential Hit		0		0				0	0	0

Building 218
Volatile Organic Compounds

Sample ID	Sample Date	Depth	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene	1,1-Dichloropropene	1,2,3-Trichlorobenzene	1,2,3-Trichloropropane	1,2,4-Trichlorobenzene
		CRQL Units	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg
218-HA01S-02	5/3/96	2.5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005
218-HA01S-03	5/3/96	5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005
218-HA02S-02	4/21/96	2.5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005
218-HA02S-03	4/21/96	5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005
218-HA03S-01	5/3/96	0.5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005
218-HA03S-02	5/3/96	2.5	<0.0011	<0.0008	<0.0015	<0.00044	<0.00325	<0.0014	<0.0024	<0.00305	<0.0025
218-HA04S-01	4/21/96	2.5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005
218-HA04S-02	4/21/96	5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005
218-HA05S-01	4/21/96	2.5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005
218-HA05S-02	4/21/96	5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005
218-HA06S-01	4/21/96	2.5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005
218-HA07S-01	4/21/96	2.5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005
218-HA07S-02	4/21/96	2.5	<0.00022	<0.00016	<0.0003	<0.000088	<0.00065	<0.00028	<0.00048	<0.00061	<0.0005

Analyses	13	13	13	13	13	13	13	13	13	13
Detections	0	0	0	0	0	0	0	0	0	0
Maximum Concentration	0	0	0	0	0	0	0	0	0	0
Arizona HBGL - Nonresidential	38500	28.6	84	4200	8				0.67	4200
Arizona HBGL - Nonresidential Hit	0	0	0	0	0				0	0

Building 218
Volatile Organic Compounds

Sample ID	Sample Date	Depth	1,2,4-Trimethylbenzene	1,2-Dibromo-3-chloro-propane (DBCP)	Bromomethane	Carbon tetrachloride	Chlorobenzene	Chloroethane	Chloroform	Chloromethane
		CRQL Units	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.01 mg/kg	0.005 mg/kg	0.01 mg/kg
218-HA01S-02	5/3/96	2.5	<0.00023	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003 ^U
218-HA01S-03	5/3/96	5	<0.00023	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003 ^U
218-HA02S-02	4/21/96	2.5	0.00093 ^J	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003
218-HA02S-03	4/21/96	5	0.00058 ^J	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003
218-HA03S-01	5/3/96	0.5	<0.00023	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003
218-HA03S-02	5/3/96	2.5	0.0092 ^{J+}	<0.0032	<0.00315	<0.0018	<0.00115	<0.00385	<0.0012	<0.015
218-HA04S-01	4/21/96	2.5	<0.00023	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003
218-HA04S-02	4/21/96	5	0.00034 ^J	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003
218-HA05S-01	4/21/96	2.5	<0.00023	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003
218-HA05S-02	4/21/96	5	<0.00023	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003
218-HA06S-01	4/21/96	2.5	<0.00023	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003
218-HA07S-01	4/21/96	2.5	<0.00023	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003
218-HA07S-02	4/21/96	2.5	<0.00023	<0.00064	<0.00063	<0.00036	<0.00023	<0.00077	<0.00024	<0.003

Analyses	13	13	13	13	13	13	13	13	13
Detections	4	0	0	0	0	0	0	0	0
Maximum Concentration	0.0092	0	0	0	0	0	0	0	0
Arizona HBGL - Nonresidential		4.07	560	42	8050		924	350	
Arizona HBGL - Nonresidential Hit		0	0	0	0		0	0	

Building 218
Volatile Organic Compounds

Sample ID	Sample Date	Depth	cis-1,2-Dichloroethene	Dibromochloromethane	Dibromomethane	Dichlorodifluoromethane	Methylene Chloride	Ethylbenzene	Hexachlorobutadiene	1-Methylethylbenzene
		CRQL Units	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.01 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg
218-HA01S-02	5/3/96	2.5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028
218-HA01S-03	5/3/96	5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028
218-HA02S-02	4/21/96	2.5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028
218-HA02S-03	4/21/96	5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028
218-HA03S-01	5/3/96	0.5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028
218-HA03S-02	5/3/96	2.5	<0.0027	<0.0014	<0.00165	<0.00275	<0.00195	0.0089 ^{J+}	<0.00235	0.017 ^{J+}
218-HA04S-01	4/21/96	2.5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028
218-HA04S-02	4/21/96	5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028
218-HA05S-01	4/21/96	2.5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028
218-HA05S-02	4/21/96	5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028
218-HA06S-01	4/21/96	2.5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028
218-HA07S-01	4/21/96	2.5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028
218-HA07S-02	4/21/96	2.5	<0.00054	<0.00028	<0.00033	<0.00033 <0.500001E-04	<0.00039	<0.00024	<0.00047	<0.00028

Analyses	13	13	13	13	13	13	13	13	13
Detections	0	0	0	0	0	0	1	0	1
Maximum Concentration	0	0	0	0	0	0	0.0089	0	0.017
Arizona HBGL - Nonresidential	4200	56		80500	756	42000		60	16450
Arizona HBGL - Nonresidential Hit	0	0		0	0	0		0	0

Building 218
Volatile Organic Compounds

Sample ID	Sample Date	Depth	Isopropyltoluene	m- & p-Xylene(s)	MTBE	n-Butylbenzene	n-Propyl benzene	Naphthalene	o-Xylene	sec-Butylbenzene	Styrene
		CRQL Units	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg
218-HA01S-02	5/3/96	2.5	<0.00037	<0.00054	<0.01	<0.00035	<0.00023	<0.00024	<0.00023	<0.00027	<0.00013
218-HA01S-03	5/3/96	5	<0.00037	<0.00054	<0.01	<0.00035	<0.00023	<0.00024	<0.00023	<0.00027	<0.00013
218-HA02S-02	4/21/96	2.5	<0.00037	0.0018 ^U	<0.01	<0.00035	<0.00023	0.0003 ^J	0.00049 ^J	<0.00027	<0.00013
218-HA02S-03	4/21/96	5	<0.00037	<0.00054	<0.01	<0.00035	<0.00023	<0.00024	<0.00023	<0.00027	<0.00013
218-HA03S-01	5/3/96	0.5	<0.00037	<0.00054	<0.01	<0.00035	<0.00023	<0.00024	<0.00023	<0.00027	<0.00013
218-HA03S-02	5/3/96	2.5	0.15	0.015 ^{J+}	<0.05	<0.00175	0.038	1	<0.00115	<0.00135	<0.00065
218-HA04S-01	4/21/96	2.5	<0.00037	<0.00054	<0.01	<0.00035	<0.00023	<0.00024	<0.00023	<0.00027	<0.00013
218-HA04S-02	4/21/96	5	<0.00037	<0.00054	<0.01	<0.00035	<0.00023	0.00033 ^J	<0.00023	<0.00027	<0.00013
218-HA05S-01	4/21/96	2.5	<0.00037	<0.00054	<0.01	<0.00035	<0.00023	0.00035 ^J	<0.00023	<0.00027	<0.00013
218-HA05S-02	4/21/96	5	<0.00037	<0.00054	<0.01	<0.00035	<0.00023	<0.00024	<0.00023	<0.00027	<0.00013
218-HA06S-01	4/21/96	2.5	<0.00037	<0.00054	<0.01	<0.00035	<0.00023	<0.00024	<0.00023	<0.00027	<0.00013
218-HA07S-01	4/21/96	2.5	<0.00037	<0.00054	<0.01	<0.00035	<0.00023	<0.00024	<0.00023	<0.00027	<0.00013
218-HA07S-02	4/21/96	2.5	<0.00037	<0.00054	<0.01	<0.00035	<0.00023	<0.00024	<0.00023	<0.00027	<0.00013

Analyses	13	13	13	13	13	13	13	13	13	13
Detections	1	2	0	0	1	4	1	0	0	0
Maximum Concentration	0.15	0.015	0	0	0.038	1	0.00049	0	0	0
Arizona HBGL - Nonresidential		805000	2030			16450	805000		8050	
Arizona HBGL - Nonresidential Hit		0	0			0	0		0	

Building 218
Volatile Organic Compounds

Sample ID	Sample Date	Depth	tert-Butylbenzene	Tetrachloroethene	Toluene	trans-1,2-Dichloroethene	Trichloroethene	Trichlorofluoromethane	Vinyl chloride
		CRQL Units	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.005 mg/kg	0.01 mg/kg
218-HA01S-02	5/3/96	2.5	<0.00028	<0.00028	<0.00025	<0.00041	<0.00027	<0.00042	<0.0015
218-HA01S-03	5/3/96	5	<0.00028	<0.00028	<0.00025	<0.00041	<0.00027	<0.00042	<0.0015
218-HA02S-02	4/21/96	2.5	<0.00028	<0.00028	0.0009900001 U	<0.00041	<0.00027	<0.00042	<0.0015
218-HA02S-03	4/21/96	5	<0.00028	<0.00028	<0.00025	<0.00041	<0.00027	<0.00042	<0.0015
218-HA03S-01	5/3/96	0.5	<0.00028	<0.00028	<0.00025	<0.00041	<0.00027	<0.00042	<0.0015
218-HA03S-02	5/3/96	2.5	<0.0014	<0.0014	<0.00125	<0.00205	<0.00135	<0.0021	<0.0075
218-HA04S-01	4/21/96	2.5	<0.00028	<0.00028	<0.00025	<0.00041	<0.00027	<0.00042	<0.0015
218-HA04S-02	4/21/96	5	<0.00028	<0.00028	<0.00025	<0.00041	<0.00027	<0.00042	<0.0015
218-HA05S-01	4/21/96	2.5	<0.00028	<0.00028	<0.00025	<0.00041	<0.00027	<0.00042	<0.0015
218-HA05S-02	4/21/96	5	<0.00028	<0.00028	<0.00025	<0.00041	<0.00027	<0.00042	<0.0015
218-HA06S-01	4/21/96	2.5	<0.00028	<0.00028	<0.00025	<0.00041	<0.00027	<0.00042	<0.0015
218-HA07S-01	4/21/96	2.5	<0.00028	<0.00028	<0.00025	<0.00041	<0.00027	<0.00042	<0.0015
218-HA07S-02	4/21/96	2.5	<0.00028	<0.00028	<0.00025	<0.00041	<0.00027	<0.00042	<0.0015

Analyses	13	13	13	13	13	13	13
Detections	0	0	1	0	0	0	0
Maximum Concentration	0	0	0.900001E-04	0	0	0	0
Arizona HBGL - Nonresidential		113	80500	8050	504	122500	3.02
Arizona HBGL - Nonresidential Hit		0	0	0	0	0	0

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Hexachlorobutadiene	Naphthalene	1,2,4,5-Tetrachloro-benzene	1,2-Diphenylhydrazine	1-Chloronaphthalene	1-Naphthylamine
		CRQL Units	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg	0.33 mg/kg
218-HA01S-02	5/3/96	2.5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-HA01S-03	5/3/96	5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-HA02S-02	4/21/96	2.5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024 ^u	<0.032	<0.025
218-HA02S-03	4/21/96	5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024 ^u	<0.032	<0.025
218-HA03S-01	5/3/96	0.5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-HA03S-02	5/3/96	2.5	<0.023	<0.022	<0.017	<0.021	<0.017	1.1	<0.013	<0.024	<0.032	<0.025
218-HA04S-01	4/21/96	2.5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024 ^u	<0.032	<0.025
218-HA04S-02	4/21/96	5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024 ^u	<0.032	<0.025
218-HA05S-01	4/21/96	2.5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-HA05S-02	4/21/96	5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-HA06S-01	4/21/96	2.5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-HA07S-01	4/21/96	2.5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-HA07S-02	4/21/96	2.5	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-SB01S-01	4/30/96	10	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-SB02S-01	4/30/96	10	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-SB02S-02	4/30/96	15	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-SB03S-01	4/30/96	10	<0.092	<0.088	<0.068	<0.084	<0.068	<0.076	<0.052	<0.096	<0.128	<0.1
218-SB04S-01	4/30/96	10	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-SB04S-02	4/30/96	15	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025
218-SB05S-01	4/30/96	11	<0.023	<0.022	<0.017	<0.021	<0.017	<0.019	<0.013	<0.024	<0.032	<0.025

Semivolatile Organic Compounds

[illegible]

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	2,3,4,6-Tetrachlorophenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2,4-Dinitrotoluene	2,6-Dinitrotoluene	2-Chloronaphthalene	2-Chlorophenol	2-Methylnaphthalene
		CRQL Units	1.7 mg/kg	1.7 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg
218-HA01S-02	5/3/96	2.5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-HA01S-03	5/3/96	5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-HA02S-02	4/21/96	2.5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21 ^u	<0.022	<0.017	<0.02	<0.017	<0.02
218-HA02S-03	4/21/96	5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21 ^u	<0.022	<0.017	<0.02	<0.017	<0.02
218-HA03S-01	5/3/96	0.5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-HA03S-02	5/3/96	2.5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	5.4
218-HA04S-01	4/21/96	2.5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21 ^u	<0.022	<0.017	<0.02	<0.017	<0.02
218-HA04S-02	4/21/96	5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21 ^u	<0.022	<0.017	<0.02	<0.017	<0.02
218-HA05S-01	4/21/96	2.5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-HA05S-02	4/21/96	5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-HA06S-01	4/21/96	2.5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-HA07S-01	4/21/96	2.5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-HA07S-02	4/21/96	2.5	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-SB01S-01	4/30/96	10	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-SB02S-01	4/30/96	10	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-SB02S-02	4/30/96	15	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-SB03S-01	4/30/96	10	<0.28	<0.092	<0.076	<0.068	<0.076	<0.84	<0.088	<0.068	<0.08	<0.068	<0.08
218-SB04S-01	4/30/96	10	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-SB04S-02	4/30/96	15	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02
218-SB05S-01	4/30/96	11	<0.07	<0.023	<0.019	<0.017	<0.019	<0.21	<0.022	<0.017	<0.02	<0.017	<0.02

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	2,3,4,6-Tetrachlorophenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol	2,4-Dinitrotoluene	2,6-Dinitrotoluene	2-Chloronaphthalene	2-Chlorophenol	2-Methylnaphthalene
		CRQL	1.7	1.7	0.33	0.33	0.33	1.7	0.33	0.33	0.33	0.33	0.33
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyses			20	20	20	20	20	20	20	20	20	20	20
Detections			0	0	0	0	0	0	0	0	0	0	1
Maximum Concentration			0	0	0	0	0	0	0	0	0	0	5.4
Arizona HBGL - Nonresidential			12250	504		1225	8050	805	8	420	32900	2030	
Arizona HBGL - Nonresidential Hits			0	0		0	0	0	0	0	0	0	

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	2-Methylphenol	2-Naphthylamine	2-Nitroaniline	2-Nitrophenol	2-Picoline	3,3-Dichlorobenzidine	3-Nitroaniline	4,6-Dinitro-2-methylphenol	4-Aminobiphenyl	4-Bromophenyl phenyl ether
		CRQL Units	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg	0.33 mg/kg	0.33 mg/kg	0.66 mg/kg	1.7 mg/kg	1.7 mg/kg	0.33 mg/kg	0.33 mg/kg
218-HA01S-02	5/3/96	2.5	<0.017	<0.031	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA01S-03	5/3/96	5	<0.017	<0.031 ^{UJ}	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA02S-02	4/21/96	2.5	<0.017	<0.031	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA02S-03	4/21/96	5	<0.017	<0.031	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA03S-01	5/3/96	0.5	<0.017	<0.031 ^{UJ}	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA03S-02	5/3/96	2.5	<0.017	<0.031	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA04S-01	4/21/96	2.5	<0.017	<0.031	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA04S-02	4/21/96	5	<0.017	<0.031	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA05S-01	4/21/96	2.5	<0.017	<0.031	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA05S-02	4/21/96	5	<0.017	<0.031	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA06S-01	4/21/96	2.5	<0.017	<0.031	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA07S-01	4/21/96	2.5	<0.017	<0.031	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-HA07S-02	4/21/96	2.5	<0.017	<0.031	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-SB01S-01	4/30/96	10	<0.017	<0.031 ^{UJ}	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-SB02S-01	4/30/96	10	<0.017	<0.031 ^{UJ}	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-SB02S-02	4/30/96	15	<0.017	<0.031 ^{UJ}	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-SB03S-01	4/30/96	10	<0.068	<0.124 ^{UJ}	<0.56	<0.068	<0.184	<0.212	<1.12	<0.68	<0.068	<0.068
218-SB04S-01	4/30/96	10	<0.017	<0.031 ^{UJ}	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-SB04S-02	4/30/96	15	<0.017	<0.031 ^{UJ}	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017
218-SB05S-01	4/30/96	11	<0.017	<0.031 ^{UJ}	<0.14	<0.017	<0.046	<0.053	<0.28	<0.17	<0.017	<0.017

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	2-Methylphenol	2-Naphthylamine	2-Nitroaniline	2-Nitrophenol	2-Picoline	3,3-Dichlorobenzidine	3-Nitroaniline	4,6-Dinitro-2-methylphenol	4-Aminobiphenyl	4-Bromophenyl phenyl ether
		CRQL Units	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg	0.33 mg/kg	0.33 mg/kg	0.66 mg/kg	1.7 mg/kg	1.7 mg/kg	0.33 mg/kg	0.33 mg/kg
Analyses			20	20	20	20	20	20	20	20	20	20
Detections			0	0	0	0	0	0	0	0	0	0
Maximum Concentration			0	0	0	0	0	0	0	0	0	0
Arizona HBGL - Nonresidential			2030		25			13				
Arizona HBGL - Nonresidential Hits			0		0			0				

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	4-Chloro-3-methylphenol	4-Chloroaniline	4-Chlorophenyl phenyl ether	4-Methylphenol	4-Nitroaniline	4-Nitrophenol	7,12-Dimethylbenz(a)-anthracene	a,a-Dimethylphenethyl-amine	Acenaphthene	Acenaphthylene
		CRQL Units	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg	1.7 mg/kg	0.33 mg/kg	0.002 mg/kg	0.33 mg/kg	0.33 mg/kg
218-HA01S-02	5/3/96	2.5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15 ^u	<0.021	<0.025
218-HA01S-03	5/3/96	5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15 ^u	<0.021	<0.025
218-HA02S-02	4/21/96	2.5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15	<0.021	<0.025
218-HA02S-03	4/21/96	5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15	<0.021	<0.025
218-HA03S-01	5/3/96	0.5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15 ^u	<0.021	<0.025
218-HA03S-02	5/3/96	2.5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15 ^u	<0.021	<0.025
218-HA04S-01	4/21/96	2.5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15	<0.021	<0.025
218-HA04S-02	4/21/96	5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15	<0.021	<0.025
218-HA05S-01	4/21/96	2.5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15	<0.021	<0.025
218-HA05S-02	4/21/96	5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15	<0.021	<0.025
218-HA06S-01	4/21/96	2.5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15	<0.021	<0.025
218-HA07S-01	4/21/96	2.5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15	<0.021	<0.025
218-HA07S-02	4/21/96	2.5	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15 ^u	<0.021	<0.025
218-SB01S-01	4/30/96	10	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15 ^u	<0.021	<0.025
218-SB02S-01	4/30/96	10	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15 ^u	<0.021	<0.025
218-SB02S-02	4/30/96	15	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15 ^u	<0.021	<0.025
218-SB03S-01	4/30/96	10	<0.1	<0.26	<0.112	<0.084	<1.16	<1.12	<0.072	<0.6 ^u	<0.084	<0.1
218-SB04S-01	4/30/96	10	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15 ^u	<0.021	<0.025
218-SB04S-02	4/30/96	15	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15 ^u	<0.021	<0.025
218-SB05S-01	4/30/96	11	<0.025	<0.065	<0.028	<0.021	<0.29	<0.28	<0.018	<0.15 ^u	<0.021	<0.025

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	4-Chloro-3-methylphenol	4-Chloroaniline	4-Chlorophenyl phenyl ether	4-Methylphenol	4-Nitroaniline	4-Nitrophenol	7,12-Dimethylbenz(a)-anthracene	a,a-Dimethylphenethyl-amine	Acenaphthene	Acenaphthylene
		CRQL Units	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg	1.7 mg/kg	0.33 mg/kg	0.002 mg/kg	0.33 mg/kg	0.33 mg/kg
Analyses			20	20	20	20	20	20	20	20	20	20
Detections			0	0	0	0	0	0	0	0	0	0
Maximum Concentration			0	0	0	0	0	0	0	0	0	0
Arizona HBGL - Nonresidential				1645		2030					24500	24500
Arizona HBGL - Nonresidential Hits				0		0					0	0

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	Acetophenone	Aniline	Anthracene	Benzidine	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzoic acid
		CRQL Units	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg
218-HA01S-02	5/3/96	2.5	<0.014	<0.025	<0.021	<0.53	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA01S-03	5/3/96	5	<0.014	<0.025	<0.021	<0.53 ^{UJ}	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA02S-02	4/21/96	2.5	<0.014	<0.025	<0.021	<0.53	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA02S-03	4/21/96	5	<0.014	<0.025	<0.021	<0.53	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA03S-01	5/3/96	0.5	<0.014	<0.025	<0.021	<0.53 ^{UJ}	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA03S-02	5/3/96	2.5	<0.014	<0.025	<0.021	<0.53	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA04S-01	4/21/96	2.5	<0.014	<0.025	<0.021	<0.53	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA04S-02	4/21/96	5	<0.014	<0.025	<0.021	<0.53	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA05S-01	4/21/96	2.5	<0.014	<0.025	<0.021	<0.53	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA05S-02	4/21/96	5	<0.014	<0.025	<0.021	<0.53	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA06S-01	4/21/96	2.5	<0.014	<0.025	<0.021	<0.53	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA07S-01	4/21/96	2.5	<0.014	<0.025	<0.021	<0.53	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-HA07S-02	4/21/96	2.5	<0.014	<0.025	<0.021	<0.53	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-SB01S-01	4/30/96	10	<0.014	<0.025	<0.021	<0.53 ^{UJ}	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-SB02S-01	4/30/96	10	<0.014	<0.025	<0.021	<0.53 ^{UJ}	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-SB02S-02	4/30/96	15	<0.014	<0.025	<0.021	<0.53 ^{UJ}	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-SB03S-01	4/30/96	10	<0.056	<0.1	0.092 ^J	<2.12	<0.068	<0.072	<0.068	<0.068	<0.068	<0.44
218-SB04S-01	4/30/96	10	<0.014	<0.025	<0.021	<0.53 ^{UJ}	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-SB04S-02	4/30/96	15	<0.014	<0.025	<0.021	<0.53 ^{UJ}	<0.017	<0.018	<0.017	<0.017	<0.017	<0.11
218-SB05S-01	4/30/96	11	<0.014	<0.025	0.039 ^J	<0.53 ^{UJ}	0.04 ^J	0.038 ^J	0.057 ^J	<0.017	<0.017	<0.11

Building 218
Semivolatile Organic Compounds

[illegible]

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	Benzyl alcohol	bis(2-Chloroethoxy)-methane	bis(2-Chloroethyl) ether	bis(2-Chloroisopropyl)-ether	bis(2-Ethylhexyl)-phthalate	Butyl benzyl phthalate	Chrysene	Di-n-butyl phthalate	Di-n-octyl phthalate	Dibenz(a,h)anthracene
		CRQL Units	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg
218-HA01S-02	5/3/96	2.5	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA01S-03	5/3/96	5	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA02S-02	4/21/96	2.5	<0.026	<0.02	<0.02	<0.019 ^U	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA02S-03	4/21/96	5	<0.026	<0.02	<0.02	<0.019 ^U	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA03S-01	5/3/96	0.5	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA03S-02	5/3/96	2.5	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA04S-01	4/21/96	2.5	<0.026	<0.02	<0.02	<0.019 ^U	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA04S-02	4/21/96	5	<0.026	<0.02	<0.02	<0.019	<0.023 ^U	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA05S-01	4/21/96	2.5	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA05S-02	4/21/96	5	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA06S-01	4/21/96	2.5	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA07S-01	4/21/96	2.5	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-HA07S-02	4/21/96	2.5	<0.026	<0.02	<0.02	<0.019 ^U	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-SB01S-01	4/30/96	10	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-SB02S-01	4/30/96	10	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-SB02S-02	4/30/96	15	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-SB03S-01	4/30/96	10	<0.104	<0.08	<0.08	<0.076	0.15 ^U	<0.068	<0.068	<0.196	<0.136	<0.068
218-SB04S-01	4/30/96	10	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-SB04S-02	4/30/96	15	<0.026	<0.02	<0.02	<0.019	<0.023	<0.017	<0.017	<0.049	<0.034	<0.017
218-SB05S-01	4/30/96	11	<0.026	<0.02	<0.02	<0.019	0.064 ^U	<0.017	<0.017	<0.049	<0.034	<0.017

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	Benzyl alcohol	bis(2-Chloroethoxy)-methane	bis(2-Chloroethyl) ether	bis(2-Chloroisopropyl)-ether	bis(2-Ethylhexyl)-phthalate	Butyl benzyl phthalate	Chrysene	Di-n-butyl phthalate	Di-n-octyl phthalate	Dibenz(a,h)anthracene
		CRQL Units	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg
Analyses			20	20	20	20	20	20	20	20	20	20
Detections			0	0	0	0	2	0	0	0	0	0
Maximum Concentration			0	0	0	0	0.15	0	0	0	0	0
Arizona HBGL - Nonresidential		122500			5	67	407	20300	462	42000	8050	0.46
Arizona HBGL - Nonresidential Hits			0		0	0	0	0	0	0	0	0

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	Dibenz(a,j)acridine	Dibenzofuran	Diethyl phthalate	Dimethyl phthalate	Diphenylamine	Ethyl methanesulfonate	Fluoranthene	Fluorene	Hexachlorobenzene	Hexachlorocyclopentadiene
		CRQL Units	0 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg
218-HA01S-02	5/3/96	2.5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-HA01S-03	5/3/96	5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	0.056 ^J	<0.024	<0.017	<0.018
218-HA02S-02	4/21/96	2.5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-HA02S-03	4/21/96	5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-HA03S-01	5/3/96	0.5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-HA03S-02	5/3/96	2.5	<0.014	0.3 ^J	<0.028	<0.024	<0.017	<0.014	<0.039	0.73	<0.017	<0.018
218-HA04S-01	4/21/96	2.5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-HA04S-02	4/21/96	5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-HA05S-01	4/21/96	2.5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-HA05S-02	4/21/96	5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-HA06S-01	4/21/96	2.5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-HA07S-01	4/21/96	2.5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-HA07S-02	4/21/96	2.5	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-SB01S-01	4/30/96	10	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-SB02S-01	4/30/96	10	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-SB02S-02	4/30/96	15	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-SB03S-01	4/30/96	10	<0.056	<0.12	<0.112	<0.096	<0.068	<0.056	0.12 ^J	<0.096	<0.068	<0.072
218-SB04S-01	4/30/96	10	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-SB04S-02	4/30/96	15	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	<0.039	<0.024	<0.017	<0.018
218-SB05S-01	4/30/96	11	<0.014	<0.03	<0.028	<0.024	<0.017	<0.014	0.11 ^J	<0.024	<0.017	<0.018

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	Dibenz(a,j)acridine	Dibenzofuran	Diethyl phthalate	Dimethyl phthalate	Diphenylamine	Ethyl methanesulfonate	Fluoranthene	Fluorene	Hexachlorobenzene	Hexachlorocyclopentadiene
		CRQL Units	0 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg
Analyses			20	20	20	20	20	20	20	20	20	20
Detections			0	1	0	0	0	0	3	1	0	0
Maximum Concentration			0	0.3	0	0	0	0	0.12	0.73	0	0
Arizona HBGL - Nonresidential					329000	4200000	10150		16450	16450	3.57	2870
Arizona HBGL - Nonresidential Hits					0	0	0		0	0	0	0

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	Hexachloroethane	Indeno(1,2,3-c,d)pyrene	Isophorone	Methyl methanesulfonate	N-Nitroso-di-n-butylamine	N-Nitroso-di-n-propylamine	N-Nitrosodimethylamine	N-Nitrosodiphenylamine	N-Nitrosopiperidine	Nitrobenzene
		CRQL Units	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg
218-HA01S-02	5/3/96	2.5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA01S-03	5/3/96	5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA02S-02	4/21/96	2.5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA02S-03	4/21/96	5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA03S-01	5/3/96	0.5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA03S-02	5/3/96	2.5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA04S-01	4/21/96	2.5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA04S-02	4/21/96	5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA05S-01	4/21/96	2.5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA05S-02	4/21/96	5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA06S-01	4/21/96	2.5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA07S-01	4/21/96	2.5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-HA07S-02	4/21/96	2.5	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-SB01S-01	4/30/96	10	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-SB02S-01	4/30/96	10	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-SB02S-02	4/30/96	15	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-SB03S-01	4/30/96	10	<0.088	<0.068	<0.08	<0.136	<0.368	<0.072	<0.1	<0.068	<0.06	<0.08
218-SB04S-01	4/30/96	10	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-SB04S-02	4/30/96	15	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02
218-SB05S-01	4/30/96	11	<0.022	<0.017	<0.02	<0.034	<0.092	<0.018	<0.025	<0.017	<0.015	<0.02

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	Hexachloroethane	Indeno(1,2,3-c,d)pyrene	Isophorone	Methyl methanesulfonate	N-Nitroso-di-n-butylamine	N-Nitroso-di-n-propylamine	N-Nitrosodimethylamine	N-Nitrosodiphenylamine	N-Nitrosopiperidine	Nitrobenzene
		CRQL Units	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg
Analyses			20	20	20	20	20	20	20	20	20	20
Detections			0	0	0	0	0	0	0	0	0	0
Maximum Concentration			0	0	0	0	0	0	0	0	0	0
Arizona HBGL - Nonresidential			340	4.6	4900		1.05	0.8	0.13	1176		203
Arizona HBGL - Nonresidential Hits			0	0	0		0	0	0	0		0

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	p-Dimethylaminoazobenzene	Pentachlorobenzene	Pentachloronitrobenzene	Pentachlorophenol	Phenacetin	Phenanthrene	Phenol	Pronamide	Pyrene
		CRQL Units	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg	1.7 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg
218-HA01S-02	5/3/96	2.5	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-HA01S-03	5/3/96	5	<0.0099	<0.019	<0.066	<0.18	<0.059	0.045 ^J	<0.022	<0.019	0.048 ^J
218-HA02S-02	4/21/96	2.5	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-HA02S-03	4/21/96	5	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-HA03S-01	5/3/96	0.5	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-HA03S-02	5/3/96	2.5	<0.0099	<0.019	<0.066	<0.18	<0.059	0.9	<0.022	<0.019	<0.026
218-HA04S-01	4/21/96	2.5	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-HA04S-02	4/21/96	5	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-HA05S-01	4/21/96	2.5	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-HA05S-02	4/21/96	5	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-HA06S-01	4/21/96	2.5	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-HA07S-01	4/21/96	2.5	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-HA07S-02	4/21/96	2.5	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-SB01S-01	4/30/96	10	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-SB02S-01	4/30/96	10	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-SB02S-02	4/30/96	15	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-SB03S-01	4/30/96	10	<0.0396	<0.076	<0.264	<0.72	<0.236	0.12 ^J	<0.088	<0.076	<0.104
218-SB04S-01	4/30/96	10	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-SB04S-02	4/30/96	15	<0.0099	<0.019	<0.066	<0.18	<0.059	<0.023	<0.022	<0.019	<0.026
218-SB05S-01	4/30/96	11	<0.0099	<0.019	<0.066	<0.18	<0.059	0.16 ^J	<0.022	<0.019	0.093 ^J

Building 218
Semivolatile Organic Compounds

Sample ID	Sample Date	Depth	p-Dimethylaminoazobenzene	Pentachlorobenzene	Pentachloronitrobenzene	Pentachlorophenol	Phenacetin	Phenanthrene	Phenol	Pronamide	Pyrene
		CRQL Units	0.33 mg/kg	0.33 mg/kg	1.7 mg/kg	1.7 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg	0.33 mg/kg
Analyses			20	20	20	20	20	20	20	20	20
Detections			0	0	0	0	0	4	0	0	2
Maximum Concentration			0	0	0	0	0	0.9	0	0	0.093
Arizona HBGL - Nonresidential				329	18.2	46			245000	3080	12250
Arizona HBGL - Nonresidential Hits				0	0	0			0	0	0

Polychlorinated Biphenyls (PCBs)

Sample ID	Sample Date	Depth	4,4-DDD	4,4-DDE	4,4-DDT	Aldrin	alpha-BHC	alpha-Chlordane	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248
			CRQL Units	0.0033 mg/kg	0.0033 mg/kg	0.0033 mg/kg	0.0017 mg/kg	0.0017 mg/kg	0.0017 mg/kg	0.033 mg/kg	0.067 mg/kg	0.033 mg/kg	0.033 mg/kg
218-HA03S-01	5/3/96	0.5	NA	NA	NA	NA	NA	NA	<0.0019	<0	<0	<0	<0
218-HA03S-02	5/3/96	2.5	NA	NA	NA	NA	NA	NA	<0.0019	<0	<0	<0	<0
218-HA06S-01	4/21/96	2.5	NA	NA	NA	NA	NA	NA	<0.0019	<0	<0	<0	<0
FSSP-SS14S-01	10/24/95	1	0.18	0.15	0.086 ^J	<0.001	<0.003	<0.0011	<0.019	<0	<0	<0	<0
FSSP-SS15S-01	10/24/95	1	0.13	0.14	0.18 ^J	<0.001	<0.003	<0.0011	<0.019	<0	<0	<0	<0

[illegible]

Building 218
Polychlorinated Biphenyls (PCBs)

Sample ID	Sample Date	Depth	Aroclor 1254	Aroclor 1260	beta-BHC	delta-BHC	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulfate	Endrin	Endrin aldehyde	Endrin ketone
		CRQL Units	0.033 mg/kg	0.033 mg/kg	0.0017 mg/kg	0.0017 mg/kg	0.033 mg/kg	0.0017 mg/kg	0.033 mg/kg	0.033 mg/kg	0.033 mg/kg	0.033 mg/kg	0.033 mg/kg
218-HA03S-01	5/3/96	0.5	<0	<0.0024	NA	NA	NA	NA	NA	NA	NA	NA	NA
218-HA03S-02	5/3/96	2.5	<0	<0.0024	NA	NA	NA	NA	NA	NA	NA	NA	NA
218-HA06S-01	4/21/96	2.5	<0	<0.0024	NA	NA	NA	NA	NA	NA	NA	NA	NA
FSSP-SS14S-01	10/24/95	1	<0	<0.024	<0.012	<0.00098	<0.0056	<0.011	<0.0025	<0.0022	<0.0063	<0.0024	<0.0026
FSSP-SS15S-01	10/24/95	1	<0	<0.024	<0.012	<0.00098	<0.0056	<0.011	<0.0025	<0.0022	<0.0063	<0.0024	<0.0026

Analyses	5	5	2	2	2	2	2	2	2	2	2	2	2
Detections	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum Concentration	0	0	0	0	0	0	0	0	0	0	0	0	0
Arizona HBGL - Nonresidential	0.76	0.76	3.19	3.19	0.38	2450	2450				123		
Arizona HBGL - Nonresidential Hits	0	0	0	0	0	0	0	0	0		0		

Building 218
Polychlorinated Biphenyls (PCBs)

Sample ID	Sample Date	Depth	gamma-BHC (Lindane)	gamma-Chlordane	Heptachlor	Heptachlor epoxide	Methoxychlor	Toxaphene
		CRQL Units	0.0017 mg/kg	0.0017 mg/kg	0.0017 mg/kg	0.0017 mg/kg	0.017 mg/kg	0.17 mg/kg
218-HA03S-01	5/3/96	0.5	NA	NA	NA	NA	NA	NA
218-HA03S-02	5/3/96	2.5	NA	NA	NA	NA	NA	NA
218-HA06S-01	4/21/96	2.5	NA	NA	NA	NA	NA	NA
FSSP-SS14S-01	10/24/95	1	<0.0035	<0.0011	<0.0034	<0.0012	<0.038	<0.23
FSSP-SS15S-01	10/24/95	1	<0.0035	<0.0011	<0.0034	<0.0012	<0.038	<0.23

Analyses	2	2	2	2	2	2
Detections	0	0	0	0	0	0
Maximum Concentration	0	0	0	0	0	0
Arizona HBGL - Nonresidential	4	4	1.3	0.63	2030	5
Arizona HBGL - Nonresidential Hits	0	0	0	0	0	0

APPENDIX I

SOIL PHYSICAL CHARACTERISTICS

APPENDIX J

QUANTERRA CERTIFICATES OF ANALYSIS

Note: Certificates of Analysis are not included in the Final Reports.
Certificates of Analysis will be provided in select copies of the Final Report.
For access to a complete copy of the Certificates of Analysis, please contact
the Camp Navajo Environmental Office at (520) 773-3208.

APPENDIX K

SCOPE OF WORK